OBE DOCUMENT

School of Pharmacy
B.Pharm

Program Code: SOP0101

Batch - 2021-2022

Vision, Mission of the University

Vision of the University

To serve the society by being a global University of higher learning in pursuit ofacademic excellence, innovation and nurturing entrepreneurship.

Mission of the University

Transformative educational experience
Enrichment by education initiatives that encourages global outlook
Develop research, support disruptive innovations and accelerate entrepreneurship
Seeking beyond boundaries

Core vaules

Integrity
Leadership
Diversity
Community

Vision and Mission of the School

Vision of the School

To become a global center of Pharmacy profession by developing students to emerge as a leaders, researchers and innovators by imparting professional & ethical values.

Mission of the School

- To deliver quality education enabling students to think critically, lead and work effortlessly across the professions.
- To enhance the professional skills & practice in the field of Pharmacy, improve health care system, education and pharmaceutical industrial application.
- To utilize sufficient human and financial resources to support academic program, improvement in infrastructure, students scholarships and faculty development and research.

Core Values

Academic excellence- We strive to achieve, through continuous improvement and adherence to institutional policies and best practices, the highest quality and standards in all our endeavors.

Leadership Development- Fostering value-based leadership among faculty members, students and staff in all their actions.

Equity-We embrace a culture of professionalism with respect for the dignity of all persons, honoring the unique contributions provided by a diversity of perspectives and cultures.

Extension Activities: School of Pharmacy serves the community through its various outreach activities in education and healthcare

Programme Educational Objectives (PEO)

Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

PEO1: To produce pharmacy graduates with strong fundamental concepts and high technical competence in pharmaceutical sciences and technology, who shall be able to use thesetools in pharmaceutical industry and/or institutes wherever necessary for success.

PEO2: To provide students with a strong and well defined concepts in the various fields of Pharmaceutical sciences *viz*., pharmaceutics, pharmaceutical chemistry, pharmacologyand pharmacognosy according to the requirement of pharmaceutical industries, Community and Hospital Pharmacy and also to develop a sense of teamwork and awareness amongst students towards the importance of interdisciplinary approach for developing competence in solving complex problems in the area of Pharmaceutical Sciences.

PEO3: To promote the development of trained human resource in Pharmaceutical Sciences for dissemination of quality education with highly professional and ethical attitude, strong communication skills, effective skills to work in a team with a multidisciplinary approach.

PEO4: To generate potential knowledge pools with interpersonal and collaborative skills toidentify, assess and formulate problems and execute the solution in closely related pharmaceutical industries.

PEO5: To train and encourage the students to participate in life-long learning process for ahighly productive career, contribute towards health care system and to relate the concepts of Pharmaceutical Sciences towards serving the cause of the society

Program Outcomes (POs)

PO1: Pharmacy Knowledge: Graduates will possess knowledge and comprehension of sciences; pharmaceutical sciences; behavioural, social, and administrative pharmacy sciences; and manufacturing practices. Graduates will have hands on training of practicalaspects of Synthesis of APIs and its intermediates along with Formulation and Development, Analysis and Quality assurance of various pharmaceutical dosage forms including those of herbal origin as per standards of official books, WHO, and other regulatory agencies.

PO2: Planning Abilities: Graduates will demonstrate effective planning abilities including time management,working independently, resource management, delegation skills and organizational skills. They would be able to develop and implement plans and organize work to meet deadlines

PO3: Thinking Ability & Problem analysis: Graduates would be able to utilize the principles of scientific inquiry, thinking analytically, clearly and critically, while solving problems and making decisions during daily practice. They would be able tofind, analyze, evaluate and apply information systematically and shall make defensible decisions. Graduates will develop an ability to conduct, analyze and interpret data of pharmaceutical experiments in various departments (Eg: Drug discovery, Formulation & Development, Production, Quality control & Quality assurance etc) as per the needs of pharmaceutical industries.

PO4: Modern tool usage: Graduates will be equipped to handle current instruments, technologies and use knowledge of mathematics and computers for drug analysisand research. They would be able to select and apply appropriate methods, procedures, resources, and modern pharmacy-related computing tools with an understanding of the limitations.

PO5: Leadership skills: Graduates would be able to understand and consider the human reaction to change, motivation issues, leadership and team-building when planning changes required for fulfillment of practice, professional and societal responsibilities. They would exhibit good managerial and entrepreneurship abilities They shall assume participatory roles as responsible citizens or leadership roles when appropriate to facilitate improvement in health and well-being.

PO6: Professional Identity: Graduates will demonstrate the ability to understand, analyze and communicate the value of their professional roles in society (e.g. health care professionals, suppliers of pharmaceuticals, promoters of health, educators, business managers, employers, employees) through consideration of historical, social, economic and political issues. Graduates will retrieve, evaluate, and apply current drug information in the delivery of pharmaceutical care and assure safe and accurate preparation, dispensing and use of medications.

PO7: Ethics: Graduates will swear by a code of ethics of Pharmacy Council of India in relation to community and shall act as integral part of a health care system. They willdemonstrate honesty, integrity, ethical understanding, and respect for others and will carry out their professional responsibilities by adhering to high ethical standards. Honor personal values and apply ethical principles in professional and social contexts.

PO8: Communication: Graduates would communicate effectively with gfhpharmacy community and with society at large, such as, being able to comprehend and write effective reports, make effective presentations and documentation, and give and receive clear instructions. They will be able to demonstrate knowledge and proficiency with current audio-visual presentation technologies and develop an ability to communicate scientific knowledge in non-expert/lay term by adopting various modes of scientific communications (e.g., abstract, manuscripts, project reports, oral and poster presentations etc).

PO9: The Pharmacist and society: Graduates will apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional pharmacy practice. They will create awareness of healthcare issues through interactions with others and will gain a sense of self-respect towards community and citizenship.

PO10: Environment and sustainability: Graduates will be able to demonstrate a high-level of understanding of the key stages in drug discovery, development, and commercialization. Understand the impact of the professional pharmacy solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO11: Life-long learning: Graduates would be able to recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Self-assess and use feedback effectivelyfrom others to identify learning needs and to satisfy these needs on an ongoing basis.

SCHOOL OF PHARMACY
B.PHARM /BATCH: 2021-2022
TERM: 1

S.No.	Paper ID	Course Code	Name of the course	Teaching Load			Credits	Core /Elective
				L	T	P		
Theory Subjects								
1.	34001	BP101T	Human Anatomy and Physiology I– Theory	3	1	-	4	**Core**
2.	34002	BP102T	Pharmaceutical Analysis I – Theory	3	1	-	4	**Core**
3.	34003	BP103T	Pharmaceutics I – Theory	3	1	-	4	**Core**
4.	34004	BP104T	Pharmaceutical Inorganic Chemistry – Theory	3	1	-	4	**Core**
5.	34005	BP105T	Communication skills – Theory *	2	-	-	2	**Core**
6.	34006 34007	BP106RBT BP106RMT	Remedial Biology/ Remedial Mathematics – Theory*	2	-	-	2	**Core**
Practical subjects								
7.	34051	BP107P	Human Anatomy and Physiology – Practical	-	-	4	2	**Core**
8.	34052	BP108P	Pharmaceutical Analysis I – Practical	-	-	4	2	**Core**
9.	34053	BP109P	Pharmaceutics I – Practical	-	-	4	2	**Core**
10.	34054	BP110P	Pharmaceutical Inorganic Chemistry – Practical	-	-	4	2	**Core**
11.	34055	BP111P	Communication skills – Practical*	-	-	2	1	**Core**
12.	34056	BP112RBP	Remedial Biology – Practical*	-	-	2	1	**Core**
Total Credits							**27/29$/30#**	

#Applicable ONLY for the students who have studied Mathematics / Physics / Chemistry at HSC andappearing for Remedial Biology (RB)course**.**

$Applicable ONLY for the students who have studied Physics / Chemistry / Botany / Zoology at HSC andappearing for Remedial Mathematics (RM)course**.**

* Non University Examination (NUE)

SCHOOL OF PHARMACY
B.PHARM /BATCH: 2021-2022
TERM: 2

S.No.	Paper ID	Course Code	Name of the course	Teaching Load			Credits	Core/Elective
				L	T	P		
Theory Subjects								
1.	34016	BP201T	Human Anatomy and Physiology II –Theory	3	1	-	4	**Core**
2.	34017	BP202T	Pharmaceutical Organic Chemistry I –Theory	3	1	-	4	**Core**
3.	34018	BP203T	Biochemistry – Theory	3	1	-	4	**Core**
4.	34019	BP204T	Pathophysiology – Theory	3	1	-	4	**Core**
5.	34020	BP205T	Computer Applications in Pharmacy – Theory*	3	-	-	3	**Core**
6.	34066	BP206T	Environmental sciences – Theory*	3	-	-	3	**Core**
Practical subjects								
7.	34067	BP207P	Human Anatomy and Physiology II –Practical	-	-	4	2	**Core**
8.	34068	BP208P	Pharmaceutical Organic Chemistry I–Practical	-	-	4	2	**Core**
9.	34069	BP209P	Biochemistry – Practical	-	-	4	2	**Core**
10.	34070	BP210P	Computer Applications in Pharmacy – Practical*	-	-	2	1	**Core**
Total Credits							**29**	

*Non University Exam

SCHOOL OF PHARMACY
B.PHARMA/BATCH: 2021-2022
TERM: 3

S. No.	Paper ID	Course Code	Name of the course	Teaching Load			Credits	Core/Elective
				L	T	P		
Theory Subjects								
1.	34151	BP301T	Pharmaceutical Organic Chemistry II – Theory	3	1	-	4	**Core**
2.	34152	BP302T	Physical Pharmaceutics I – Theory	3	1	-	4	**Core**
3.	34153	BP303T	Pharmaceutical Microbiology – Theory	3	1	-	4	**Core**
4.	34154	BP304T	Pharmaceutical Engineering – Theory	3	1	-	4	**Core**
Practical subjects								
5.	34155	BP305P	Pharmaceutical Organic Chemistry II – Practical	-	-	4	2	**Core**
6.	34156	BP306P	Physical Pharmaceutics I – Practical	-	-	4	2	**Core**
7.	34157	BP307P	Pharmaceutical Microbiology – Practical	-	-	4	2	**Core**
8.	34158	BP 308P	Pharmaceutical Engineering – Practical	-		4	2	**Core**
Total Credits							**24**	

SCHOOL OF PHARMACY
B. PHARMA/BATCH: 2021-2022
TERM: 4

S.No.	Paper ID	Course Code	Name of the course	Teaching Load			Credits	Core/Elective
				L	T	P		
Theory Subjects								
1.	34171	BP401T	Pharmaceutical Organic Chemistry III–Theory	3	1	-	4	**Core**
2.	34172	BP402T	Medicinal Chemistry I – Theory	3	1	-	4	**Core**
3.	34173	BP403T	Physical Pharmaceutics II – Theory	3	1	-	4	**Core**
4.	34174	BP404T	Pharmacology I – Theory	3	1	-	4	**Core**
5.	34175	BP405T	Pharmacognosy and Phytochemistry I– Theory	3	1	-	4	**Core**
Practical subjects								
6.	34176	BP406P	Medicinal Chemistry I – Practical	-	-	4	2	**Core**
7.	34177	BP407P	Physical Pharmaceutics II – Practical	-	-	4	2	**Core**
8.	34178	BP408P	Pharmacology I – Practical	-	-	4	2	**Core**
9.	34179	BP409P	Pharmacognosy and Phytochemistry I – Practical	-	-	4	2	**Core**
Total Credits							**28**	

SCHOOL OF PHARMACY
B. PHARMA/BATCH: 2021-2022
TERM: 5

S.No.	Paper ID	Course Code	Name of the course	Teaching Load			Credits	Core/Elective
				L	T	P		
Theory Subjects								
1.	34182	BP501T	Medicinal Chemistry II – Theory	3	1	-	4	**Core**
2.	34183	BP502T	Industrial PharmacyI– Theory	3	1	-	4	**Core**
3.	34184	BP503T	Pharmacology II – Theory	3	1	-	4	**Core**
4.	34185	BP504T	Pharmacognosy and Phytochemistry II–Theory	3	1	-	4	**Core**
5.	34186	BP505T	Pharmaceutical Jurisprudence – Theory	3	1	-	4	**Core**
Practical subjects								
6.	34187	BP506P	Industrial PharmacyI – Practical	-	-	4	2	**Core**
7.	34188	BP507P	Pharmacology II – Practical	-	-	4	2	**Core**
8.	34189	BP508P	Pharmacognosy and Phytochemistry II – Practical	-	-	4	2	**Core**
Total Credits							**26**	

SCHOOL OF PHARMACY
B. PHARMA/BATCH: 2021-2022
TERM: 6

S.No.	aperID	Course Code	Name of the course	Teaching Load			Credits	Core/Elective
				L	T	P		
Theory Subjects								
1.	34190	BP601T	Medicinal Chemistry III – Theory	3	1	-	4	**Core**
2.	34191	BP602T	Pharmacology III – Theory	3	1	-	4	**Core**
3.	34192	BP603T	Herbal Drug Technology – Theory	3	1	-	4	**Core**
4.	34193	BP604T	Biopharmaceutics and Pharmacokinetics – Theory	3	1	-	4	**Core**
5.	34194	BP605T	Pharmaceutical Biotechnology – Theory	3	1	-	4	**Core**
6.	34195	BP606T	Quality Assurance – Theory	3	1	-	4	**Core**
Practical subjects								
7.	34196	BP607P	Medicinal chemistry III – Practical	-	-	4	2	**Core**
8.	34197	BP608P	Pharmacology III – Practical	-	-	4	2	**Core**
9.	34198	BP609P	Herbal Drug Technology – Practical	-	-	4	2	**Core**
Total Credits							**30**	

SCHOOL OF PHARMACY
B. PHARMA/BATCH: 2021-2022
TERM: 7

S.No.	Paper ID	Course Code	Name of the course	Teaching Load			Credits	Core/Elective
				L	T	P		
Theory Subjects								
1.	34209	BP701T	Instrumental Methods of Analysis –Theory	3	1	-	4	**Core**
2.	34210	BP702T	Industrial PharmacyII – Theory	3	1	-	4	**Core**
3.	34211	BP703T	Pharmacy Practice – Theory	3	1	-	4	**Core**
4.	34212	BP704T	Novel Drug Delivery System – Theory	3	1	-	4	**Core**
Practical subjects								
5.	34213	BP705P	Instrumental Methods of Analysis –Practical	-	-	4	2	**Core**
6.	34214	BP706PS	Practice School*	-	-	12	6	**Core**
Total Credits							**24**	

*Non University Exam

SCHOOL OF PHARMACY
B.PHARMA/BATCH: 2021-2022
TERM: 8

S.No.	Paper ID	Course Code	Name of the course	Teaching Load			Credits	Core/Elective
				L	T	P		
Theory Subjects								
1.	34215	BP801T	Biostatistics and Research Methodology	3	1	-	4	**Core**
2.	34216	BP802T	Social and Preventive Pharmacy	3	1	-	4	**Core**
3.	34217	BP803ET	Pharma Marketing Management	3 +3 = 6	1+1=2	-	4+4=8	**Elective**
4.	34218	BP804ET	Pharmaceutical Regulatory Science					**Elective**
5.	34219	BP805ET	Pharmacovigilance					**Elective**
6.	34220	BP806ET	Quality Control and Standardization of Herbals					**Elective**
7.	34221	BP807ET	Computer Aided Drug Design					**Elective**
8.	34222	BP808ET	Cell and Molecular Biology					**Elective**
9.	34223	BP809ET	Cosmetic Science					**Elective**
10.	34224	BP810ET	Experimental Pharmacology					**Elective**
11.	34225	BP811ET	Advanced Instrumentation Techniques					**Elective**
12.	34226	BP812ET	Dietary Supplements and Nutraceuticals					**Elective**
13.	34227	BP813PW	Project Work	-	-	12	6	**Core**
Total Credits							**22**	

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: 1**
1	Course Code	BP101 T
2	Course Title	Human Antomy & Physiology I – Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of this course the student should be able to 1. Understand the mechanism of drug action and its relevance in the treatment of different diseases 2. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments 3. Demonstrate the various receptor actions using isolated tissue preparation 4. Appreciate correlation of pharmacology with related medical sciences
6	Course Outcomes	CO101.1: The students will understand the structure and functions of various tissues andorgans of the body. Also correlate their relevance with each other. CO101.2: The student will be able to summarize the functioning of various body systemsand their homeostasis. CO101.3: The student will be able to apply the knowledge of the anatomy and physiologyof different body parts in explaining the working patterns of different body systems. CO101.4: The students will analyze the structures of various tissues and their origin toevaluate their damage and repair process. CO101.5: The students would evaluate the mechanisms of various processes on which thefunctioning of the various body organs depend. Moreover, will observe the anatomical differentiation of different body parts.
7	Outline syllabus	
	1	**UNIT-I** **Introduction to human body** Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basicanatomical terminology. **Cellular level of organization** Structure and functions of cell, transport across cell membrane, celldivision, cell junctions. General principles ofcell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine • **Tissue level of organization** Classification of tissues, structure, location and functions of epithelial,muscular and nervous and connective tissues.
	2	**UNIT-II**

		Integumentary system Structure and functions of skin • **Skeletal system** Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction **Joints** Structural and functional classification, types of joints movements and its Articulation		
	3	**UNIT-III** • **Body fluids and blood** • Body fluids, composition and functions of blood, hemopoeisis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system. • **Lymphatic system** Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system		
	4	**UNIT-IV** **Peripheral nervous system**: Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves. • **Special senses** Structure and functions of eye, ear, nose and tongue and their disorders.		
	5	**UNIT-V** **Cardiovascular system** Heart – anatomy of heart, blood circulation, blood vessels, structure andfunctions of artery, vein and capillaries, elements of conduction system of heart and heartbeat, its Regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation ofblood pressure, pulse, electrocardiogram and disorders of heart.		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi. 2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, ChurchillLivingstone, New York 3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins		

		Co,Riverview,MI USA 4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH,U.S.A. 5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
	OtherReferences	

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: 1**
1	Course Code	BP102T
2	Course Title	Pharmaceutical Analysis I- Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of this course the student should be able to 1. Understand the mechanism of drug action and its relevance in the treatment of different diseases 2. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments 3. Demonstrate the various receptor actions using isolated tissue preparation 4. Appreciate correlation of pharmacology with related medical sciences
6	Course Outcomes	**CO102.1**: Students shall have knowledge about the complete actual pharmaceutical analysis animportant and uses in pharmacy. **CO102.2:** Students will be able to understand about different types of analytical techniques and ɒexplain those techniques. **CO102.3:** Students can apply their anlaytical knowledge by using experimental techniques likeof titrtation for different molecule and drugs. **CO102.4:** Students will be able to explain differentiation between volumetric, quantitative and eleanalysis. **CO102.5:** Students will be able to generalize and modify analytical techniques according to analyte.
7	Outline syllabus	
	1	**UNIT-I** **Pharmaceutical Analysis** **Definition and scope** Definition and scope i) Different techniques of analysis ii) Methods of expressing concentration iii) Primary and secondary standards. iv) Preparation and standardization of various molar and normal solutions Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate. (b)Errors: Sources of errors, types of errors, methods of minimizing errors, accuracy,precision and significant figures.
	2	**UNIT-II** **Acid base titration & Non aqueous titration** Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves Non aqueous titration: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl

<table>
<tr><td></td><td>3</td><td colspan="3">UNIT-III
Precipitation titrations, Complexometric titration & Gravimetry, Diazotization
Precipitation titrations: Mohr’s method, Volhard’s, Modified Volhard’s, Fajans method, estimation of sodium chloride. Complexometric titration: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate. Gravimetry: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate. Define the Diazotization with their principle, methodology and their uses</td></tr>
<tr><td></td><td>4</td><td colspan="3">UNIT-IV
Redox titrations
Concepts of oxidation and reduction
Types of redox titrations (Principles and applications) Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate.</td></tr>
<tr><td></td><td>5</td><td colspan="3">UNIT-V
Electrochemical methods of analysis
Conductometry- Introduction, Conductivity cell, Conductometric titrations, applications. Potentiometry - Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrodes), methods to determine end point of potentiometric titration and applications. Polarography - Principle, Ilkovic equation, construction and working of dropping mercury electrode androtating platinum substituent on Basicity. Qualitative test, Structure anduses of Ethanolamine, Ethylenediamine, Amphetamine
electrode, applications</td></tr>
<tr><td></td><td>Mode of examination</td><td colspan="3">Theory/Jury/Practical/Viva</td></tr>
<tr><td></td><td rowspan="2">Weightage Distribution</td><td>Continuous Mode Assessment</td><td>Sessional Exam</td><td>ESE</td></tr>
<tr><td>10 Marks</td><td>15</td><td>75</td></tr>
<tr><td></td><td>Text book/s*</td><td colspan="3">1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, StahlonePress of University of London
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry
5. John H. Kennedy, Analytical chemistry principles
6. Indian Pharmacopoeia.</td></tr>
<tr><td></td><td>Other References</td><td colspan="3"></td></tr>
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School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: 1**
1	Course Code	BP103T
2	Course Title	Pharmaceutics I - Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of this course the student should be able to 1. Understand the mechanism of drug action and its relevance in the treatment of different diseases 2. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments 3. Demonstrate the various receptor actions using isolated tissue preparation 4. Appreciate correlation of pharmacology with related medical sciences
6	Course Outcomes	**CO103.1**: The students will be able to define the principle procedures of general formulation, classification of different dosage forms. The student will be able to recognize various routes of drug administration, to know about various Pharmacopoeias-IP, BP, USPetc. **CO103.2:** The student will be able to understand the professional way of handling the prescription, excipients used in different dosage forms, various factors affecting Posology and solubility enhancement techniques. **CO103.3:** The students will be able to illustrate different methods of preparation of various semisolid dosage forms and how to calculate the dose of pediatric patients, different calculations based on Imperial & Metric system. **CO103.4:** The students will be able to distinguish between various Monophasic and biphasic liquids. They will also be able to explain about different types of semisolid dosage forms like suspension, emulsion, ointments, pastes, creams etc. **CO103.5:** The students will be able to predict stability problems in different dosage forms.
7	Outline syllabus	
	1	**UNIT-I** • **Historical background and development of profession of pharmacy**: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia. • **Dosage forms:** Introduction to dosage forms, classification and definitions • **Prescription:** Definition, Parts of prescription, handling of Prescription andErrors in prescription. • **Posology:** Definition, Factors affecting posology. Pediatric dose calculationsbased on age, body weight and body surface area.

<table>
<tr><td></td><td>2</td><td colspan="3">UNIT-II
Pharmaceutical Calculations, Powders, Liquid dosage forms
Weight & Measures, Calculation involvingPercentage solution etc.
Definition of Powders, EutecticMixtures, Geometric Dilutions.
Solubility enhancement techniques
Advantages & disadvantage of liquid dosage forms.</td></tr>
<tr><td></td><td>3</td><td colspan="3">UNIT-III
Monophasic and Biphasic liquids
Introduction of various monophasic liquids such as gargles, syrups, liniments, Eardrops etc.
Suspensions, different types of suspension & stability problems & methods to overcome
Emulsions, classification & different methods of preparation, stability problems& methods to overcome</td></tr>
<tr><td></td><td>4</td><td colspan="3">UNIT-IV
Pharmaceutical Incompatibilities &Suppositories
• Definition and classification of different pharmaceuticalincompatibilities
• Suppositories: types, methods of preparartion, types of base, Evaluation and Displacementvalue.</td></tr>
<tr><td></td><td>5</td><td colspan="3">UNIT-V
Semisolid Dosage Forms
□ Definition, classification, Mechanism Preparation ofointments, paste, creams, gels.
□ Excipients used and Evaluationof semi solid dosage forms.</td></tr>
<tr><td></td><td>Mode of examination</td><td colspan="3">Theory/Jury/Practical/Viva</td></tr>
<tr><td></td><td rowspan="2">Weightage Distribution</td><td>Continuous Mode Assessment</td><td>Sessional Exam</td><td>ESE</td></tr>
<tr><td>10 Marks</td><td>15</td><td>75</td></tr>
<tr><td></td><td>Text book/s*</td><td colspan="3">1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, LippincottWilliams and Walkins, New Delhi.
2. Carter S.J., Cooper and Gunn’s-Dispensing for Pharmaceutical Students, CBS publishers,New Delhi.
3. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone,Edinburgh.
4. Indian pharmacopoeia.
5. British pharmacopoeia.
6. Lachmann. Theory and Practice of Industrial Pharmacy, Lea & Febiger Publisher, The University of Michigan.</td></tr>
</table>

		7. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, LippincottWilliams, New Delhi. 8. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi. 9. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society,Elsevier Health Sciences, USA. 10. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC,New York. 11. Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker,INC, New York. 12. Francoise Nieloud and Gilberte Marti-Mestres:Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC, New York.
	Other References	

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: 1**
1	Course Code	BP104T
2	Course Title	Pharmaceutical Inorganic Chemistry -Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of this course the student should be able to 1. Understand the mechanism of drug action and its relevance in the treatment of different diseases 2. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments 3. Demonstrate the various receptor actions using isolated tissue preparation 4. Appreciate correlation of pharmacology with related medical sciences
6	Course Outcomes	**CO104.1** Students shall be able to illustrate sources of impurities and theircontrolin inorganic drugs and pharmaceuticals. **CO104.2** Students shall be able to explain concept of acids, bases and buffers andmethods of calculating and adjusting isotonicity. **CO104.3** Students shall be able to discuss major intra and extracellular ions, replacement therapy and physiological acid-base balance. **Co104.4** Students shall be able to evaluate medicinal and Pharmaceutical importance of inorganic compound, like gastrointestinal agents, dentalproducts and antimicrobials. **CO104.5** Discuss about radiopharmaceuticals, their handling, hazards and uses.
8	Outline syllabus	
	1	**UNIT-I** **Impurities in pharmaceutical substances** History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test forChloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate
	2	**UNIT-II** **Acids, Bases and Buffers Major extra and intracellular electrolytes, Dental products** Buffer equations and buffer capacity in general, buffers in pharmaceuticalsystems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting tonicity. Functions of major physiologicalions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinceugenol cement.
	3	**UNIT-III**

		Gastrointestinal agents Acidifiers: Ammonium chloride*and Dil. HCl Antacid: Ideal properties of antacids, ombinations of antacids, Sodium 40 Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodineand its preparation		
	4	**UNIT-IV** **Miscellaneous compounds** Expectorants: Potassium iodide, Ammonium chloride*. Emetics: Copper sulphate*, Sodium potassium tartarate Haematinics: Ferrous sulphate*, Ferrous gluconate Poison and Antidote: Sodium thiosulphate*, Activated charcoal Sodium nitrite Astringents: Zinc Sulphate, Potash Alum		
	5	**UNIT-V** **Radiopharmaceuticals** Radio activity, Measurement of radioactivity, Properties of α, β, γ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide I131 , Storage conditions, precautions & pharmaceutical application of radioactive substances.		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II,Stahlone Press of University of London, 4th edition. 2. A.I. Vogel, Text Book of Quantitative Inorganic analysis 3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd Edition 4. M.L Schroff, Inorganic Pharmaceutical Chemistry 5. Bentley and Driver's Textbook of Pharmaceutical Chemistry 6. Anand & Chatwal, Inorganic Pharmaceutical Chemistry		

School:		**SOP**
Program:		**B.Pharma**
Branch:		**Semester: 1**
1	Course Code	BP106 RBT
2	Course Title	Remedial biology - Theory
3	Credits	4
4	Contact Hours (L-T-P)	2-0-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the course, the student shall be able to -Know the classification and salient features of five kingdoms of life -Understand the basic components of anatomy & physiology of plant -Know understand the basic components of anatomy & physiologyanimal with special reference to human
6	Course Outcomes	**CO106RBT.1:** Students would acquire knowledge of five kingdoms of life, morphology and anatomy of flowering plants, anatomy and physiology of plants and humans and various plant growth regulators. **CO106RBT.2:** Students would be able to understand the anatomy and physiology of plants and humans. **CO106RBT.3:** Students will be able to apply the knowledge of the anatomy and physiology of different body parts in explaining the working patternsof different body systems. **CO106RBT.4:** The students will analyze the structures of various tissues andtheir origin. **CO106RBT.5:** The students would evaluate the mechanisms of various processes on which the functioning of the various body organs and plantsdepend. Moreover, will observe the anatomical differentiation of differentbody parts of human.
7	Outline syllabus	
	1	**UNIT-I** **Living world:** Definition and characters of living organisms Diversity in the living world Binomial nomenclature Five kingdoms of life and basis of classification. Salient features of Monera, Potista, Fungi, Animalia and Plantae, Virus, **Morphology of Flowering plants** Morphology of different parts of flowering plants – Root,stem, inflorescence, flower, leaf, fruit, seed. General Anatomy of Root, stem, leaf of monocotyledons & Dicotylidones
	2	**UNIT-II** **Body fluids and circulation** Coposition of blood, blood groups, coagulation of blood Composition and functions of lymph Human circulatory system Structure of human heart and blood vessels Cardiac cycle, cardiac output and ECG

		Digestion and Absorption Human alimentary canal and digestive glands Role of digestive enzymes Digestion, absorption and assimilation of digested food **Breathing and respiration** Human respiratory system Mechanism of breathing and its regulation Exchange of gases, transport of gases and regulation of respiration Respiratory volumes		
	3	**UNIT-III** **Excretory products and their elimination** Modes of excretion Human excretory system- structure and functionUrine formation Rennin angiotensin system **Neuralcontrol and coordination** Definition and classification of nervous systemStructure of a neuron Generation and conduction of nerve impulseStructure of brain and spinal cord Functions of cerebrum,cerebellum,hypothalamus andmedulla oblongata **Chemical coordination and regulation** Endocrine glands and their secretions Functions of hormones secreted by endocrine glands **Human reproduction** Parts of female reproductive system Parts of male reproductive system Spermatogenesis and Oogenesis Menstrual cycle		
	4	**UNIT-IV** **Plants and mineral nutrition:** Essential mineral, macro and micronutrients Nitrogen metabolism, Nitrogen cycle, biological nitrogenfixation **Photosynthesis** Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis.		
	5	**UNIT-V** **Plant Respiration:** Respiration, glycolysis, fermentation (anaerobic). **Plant growth and development** Phases and rate of plant growth, Condition of growth,Introduction to plant growth regulators **Cell - The unit of life** Structure and functions of cell and cell organelles.Celldivision **Tissues** Definition, types of tissues, location and functions.		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75

	Text book/s*	a. Text book of Biology by S. B. Gokhale b. A Text book of Biology by Dr. Thulajappa and Dr. Seetaram.
	Other References	a. A Text book of Biology by B.V. Sreenivasa Naidu b. A Text book of Biology by Naidu and Murthy c. Botany for Degree students By A.C.Dutta. d. Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Ananthakrishnan. e. A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: 1**
1	Course Code	BP106 RMT
2	Course Title	Remedial Mathematics - Theory
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the course, the student shall be able to -Know the classification and salient features of five kingdoms of life -Understand the basic components of anatomy & physiology of plant -Know understand the basic components of anatomy & physiologyanimal with special reference to human
6	Course Outcomes	**CO106RMT.1:** Students would acquire knowledge of partial fraction and logarithms **CO106RMT.2:** Students would be able to understand about matrices and determinants **CO106RMT.3:** Students will be able to apply the knowledge of Differentiation. **CO106RMT.4:** Students will be able to apply the knowledge of Integration **CO106RMT.5:** Students will be able to understand differential equations .
7	Course Description	This is an introductory course in mathematics. This subject deals with the introduction to Partial fraction, Logarithm, matrices and Determinant, Analytical geometry, Calculus, differential equation and Laplace transform.
8	Outline syllabus	
	1	**UNIT – I** **06 Hours** **Partial fraction** Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction , Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics and Pharmacokinetics **Logarithms** Introduction,Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems. **Function**: Real Valued function, Classification of real valued functions, **Limits and continuity** : Introduction , Limit of a function, Definition of limit of a function
	2	**UNIT–II** **06 Hours** **Matrices and Determinant:** Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants , Product of determinants, Minors and co-Factors, Adjoint or adjugate of a square matrix , Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear of equations using matrix method, Cramer's rule, Characteristic equation and roots

		of a square matrix, Cayley–Hamilton theorem,Applicationof Matrices in solving Pharmacokinetic equations		
	3	**UNIT–III** **06 Hours** **Calculus Differentiation** : Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function , Derivativeof the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions(Quotient formula) – **Without Proof**, Derivative of x^n *w.r.t*x,where *n* is anyrational number, Derivative of e^x,, Derivative of $\log_e x$, Derivative ofa^x,Derivative of trigonometric functions from first principles **(without Proof)**, Successive Differentiation, Conditions for a function to be amaximum or a minimum at a point. Application		
	4	**UNIT–IV** **06 Hours** • **Analytical Geometry** **Introduction:** Signs of the Coordinates, Distance formula, **Straight Line** : Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope – intercept form of a straight line **Integration:** Introduction, Definition, Standard formulae, Rules of integration , Method of substitution, Method of Partial fractions, Integration by parts, definite integrals, application		
	5	**UNIT-V** **06 Hours** **Differential Equations:** Some basic definitions, Order and degree, Equations in separable form , Homogeneous equations, Linear Differential equations, Exact equations, **Application in solving Pharmacokinetic equations** **Laplace Transform:** Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, InverseLaplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, **Application in solving Chemical kinetics and Pharmacokinetics equations**		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. Differential Calculus by Shanthinarayan 2. Pharmaceutical Mathematics with application to Pharmacy by PanchaksharappaGowda D.H. 3. Integral Calculus by Shanthinarayan 4. Higher Engineering Mathematics by Dr.B.S.Grewal		
	Other References			

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: 1**
1	Course Code	BP107P
2	Course Title	**Human Anatomy and Physiology- Practical**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	1. To understand how to handle the microscope in Human Anatomy & Physiology lab 2. To calculate Hb content, WBC & RBC count and Erythrocyte 3. To identify axial and skeletal bones of Human skeleton 4.To learn and practice how to record Blood Pressure of given subject
6	Course Outcomes	**CO107.1**: Understand how to handle the microscope in Human Anatomy & Physiology lab **CO107.2**: Calculate Hb content, WBC & RBC count and Erythrocyte sedimentation rate **CO107.3**: Identify axial and skeletal bones of Human skeleton **CO107.4**: Record Blood Pressure of given subject
7	Course Description	Practical physiology is complimentary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insighton the subject.
8	Outline syllabus	
	1	**UNIT-I** **S**tudy of compound microscope Microscopic study of epithelial and connective tissue Microscopic study of muscular and nervous tissue
	2	**UNIT-II** Identification of axial bones Identification of appendicular bones
	3	**UNIT-III** Introduction to hemocytometry and enumeration of whiteblood cell (WBC) count Enumeration of total red blood corpuscles (RBC) count Determination of bleeding time 10. Determination ofclotting time
	4	**UNIT-IV** Determination of blood group Estimation of hemoglobin content Determination of erythrocyte sedimentation rate (ESR)
	5	**UNIT-V** Determination of heart rate and pulse rate Recording of blood pressure
	Mode of examination	Theory/Jury/Practical/Viva

	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		05	10	35
	Text book/s*	1.Essentials of Medical Physiologyy K.Sembulingam and P.Sembulingam. Jaypee brothers medical publishers, New Delhi. 2.Anatomy and Physiology in Health and Illness by Kathleen W.Wilson ,Churchil lLivingstone,NewYork		
	Other References	Physiological basis of Medical PracticeBestandTailor.Williams&Wilkins Co,Riverview,MI USA		

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: 1**
1	Course Code	BP108P
2	Course Title	**Pharmaceutical Analysis – Practical**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	Upon completion of the course, the student shall be able to -Know the classification and salient features of five kingdoms of life -Understand the basic components of anatomy & physiology of plant -Know understand the basic components of anatomy & physiology animal with special reference to human
6	Course Outcomes	Upon completion of course student shall be able to know **CO108.1** The limits of impurities in a particular drug and to perform limittest to identify and determine the impurities in analye and pharmaceuticals. **CO108.2** Students shall be able to perform standardization and analyze given sample strength of drug or pharmaceuticals. **CO108.3**Students shall be able to know the purity testing of drugs and pharmaceuticals. They can apply these strength tests to analyze and evaluate the sample. **CO108.4**Students shall be able to understand about electrochemical analysis for pharmaceutical sample.
7	Course Description	Deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs
8	Outline syllabus	
	1	**UNIT-I** Limit test for Chlorides and Sulphates Modified limit test for Chlorides and Sulphates Limit test for Iron Limit test for Heavy metals Limit test for Lead Limit test for Arsenic
	2	**UNIT-II** Sodium hydroxide Sulphuric acid Sodium thiosulfate Potassium permanganate Ceric ammonium sulphate
	3	**UNIT-III** Ammonium chloride by acid base titration Sodium Chloride by precipitation titration
	4	**UNIT-IV** Conductometric titration of strong acid againststrong base
	5	**UNIT-V**

		Sodium hydroxide Sulphuric acid Sodium thiosulfate		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		05	10	35
	Text book/s*	Practical human anatomy and physiology. byS.R.Kale and R.R.Kale. A Manual of pharmaceutical biology practical byS.B.Gokhale, C.K.Kokate and S.P.Shriwastava. Biology practical manual according to Nationalcore curriculum. Biology forum of Karnataka. Prof M.J.H.Shafi		

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: 1**
1	Course Code	BP109P
2	Course Title	**Pharmaceutics –I Practical**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	This course will impart basic knowledge in the area of pharmaceutics and formulation of different pharmaceutical dosage forms. The students will get hands-on training in thepreparation of such dosage forms in the laboratory.
6	Course Outcomes	**CO109.1** Upon completion of course student shall be able to tell the different methods of preparation of various monophasic and biphasic liquid dosage forms. **CO109.2** Students shall be able to identify specific types of excipients used in preparation of semisolid dosage forms. **CO109.3**Students shall be able to prepare different types of pharmaceutical dosage forms syrups, elixirs, solutions, paints, gargles, mouth washes, suspensions, emulsions, powders, ointments, pastes etc. **CO109.4**Students shall be able to differentiate between different methods of preparation of pharmaceutical dosage forms.
7	Course Description	This course is designed to impart knowledge on preparatory pharmacy and professionalway of preparing various dosage forms such as monophasic liquids, biphasic liquids, semisolid dosage forms etc.
8	Outline syllabus	
	1	**UNIT-I** **Syrups** Syrup IP'66 Compound syrup of Ferrous Phosphate BPC'68 **Elixirs** Piperazine citrate elixir Paracetamol pediatric elixir
	2	**UNIT-II** **Linctus** Terpin Hydrate Linctus IP'66 Iodine Throat Paint (Mandles Paint) **Solutions** Strong solution of ammonium acetate Cresol with soap solution Lugol's solution
	3	**UNIT-III** **Suspensions** Calamine lotion Magnesium Hydroxide mixture

		Aluminimum Hydroxide gel **Emulsions** Turpentine Liniment Liquid paraffin emulsion		
	4	**UNIT-IV** **Powders and Granules** ORS powder (WHO) Effervescent granules Dusting powder Divided powders **Suppositories** Glycero gelatin suppository Coca butter suppository Zinc Oxide suppository		
	5	**UNIT-V** **Semisolids** Sulphur ointment Non-staining-iodine ointment with methyl salicylate Carbopal gel **Gargles and Mouthwashes** Iodine gargle Chlorhexidine mouthwash		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, LippincottWilliams and Walkins, New Delhi. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBSpublishers, New Delhi. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh. 1. Indian pharmacopoeia. 2. British pharmacopoeia.		
	Other References			

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: I**
1	Course Code	BP110P
2	Course Title	Pharmaceutical inorganic chemistry- Practical
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	Upon completion of the course, the student shall be able to -Know the classification and salient features of five kingdoms of life -Understand the basic components of anatomy & physiology of plant -Know understand the basic components of anatomy & physiology animal with special reference to human
6	Course Outcomes	**Upon** completion of course student shall be able to know **CO110.1** the limits of impurities in a particular drug and to perform limit test to identify and determine the impurities in inorganic drugs and pharmaceuticals. **CO110.2** Students shall be able to perform identification test and analyze given sample of drug or pharmaceuticals. **CO110.3** Students shall be able to know the purity testing of inorganic drugs and pharmaceuticals. They can apply these purity tests to analyze and evaluate the sample. **C0110.4** Students shall be able to know methods of preparation of drugs and pharmaceuticals. **C0110.5** Students shall be able to know methods of preparation of various inorganic drugs.
7	Course Description	Limit test for non- toxic and toxic impurities, identification test for some Drugs, preparation of some drugs and purity test for some inorganic drugs and pharmaceuticals.
8	Outline syllabus	
	1	**UNIT-I** Limit test for Chlorides and Sulphates Modified limit test for Chlorides and Sulphates Limit test for Iron Limit test for Heavy metals Limit test for Lead Limit test for Arsenic
	2	**UNIT-II** Magnesium hydroxide Ferrous sulphate Sodium bicarbonate Calcium gluconate Copper sulphate
	3	**UNIT-III** Swelling power of Bentonite

		Neutralizing capacity of aluminum hydroxidegel Determination of potassium iodate and iodinein potassium Iodide		
	4	**UNIT-IV** Boric acid Potash alum Ferrous sulphate		
	5	**UNIT-V** Ferrous sulphate Sodium bicarbonate		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	Practical human anatomy and physiology. byS.R.Kale and R.R.Kale. A Manual of pharmaceutical biology practical byS.B.Gokhale, C.K.Kokate and S.P.Shriwastava. Biology practical manual according to Nationalcore curriculum .Biology forum of Karnataka. ProfM.J.H.Shafi		
	Other References			

School:		**SOP**		
Program:		**B.Pharm**		
Branch:		**Semester: 1**		
1	Course Code	BP112 RBP		
2	Course Title	Remedial biology Practical		
3	Credits	2		
4	Contact Hours (L-T-P)	0-0-2		
	Course Type	Compulsory		
5	Course Objective	1. To understand how to handle the microscope in lab. 2. To identify axial and skeletal bones of Human skeleton 3. To learn and practice how to record Blood Pressure of given subject. 4. To Study morphology and microscopy of Stem, Root, Leaf, seed, fruit, flower and their modifications. 5. Identification of blood group.		
6	Course Outcomes	Students will be able to CO112.1: Understand how to handle the microscope in lab. CO112.2: Identify axial and skeletal bones of Human skeleton CO112.3: Record Blood Pressure of given subject. CO112.4: study Morphological and histological characteristics of Root, Stem, Leaf, Seed, Fruit and Flower. CO112.5: determine the blood group of subject.		
7	Course Description	Practical is complimentary to the theoretical discussions remedial biologyand allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings and plants. This is helpful for developing an insight on the subject.		
8	Outline syllabus			
	1	**UNIT-I** Study of compound microscope Microscopic study of leaves and flowers Microscopic study of roots and stem		
	2	**UNIT-II** Identification of axial bones Identification of appendicular bones		
	3	**UNIT-III** Determination of blood group Estimation of hemoglobin content		
	4	**UNIT-IV** Determination of heart rate and pulse rate		
	5	**UNIT-V** Recording of blood pressure		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage	**Continuous**	Sessional	ESE

	Distribution	**Mode Assessment**	Exam	
		10 Marks	15	75
	Text book/s*	Practical human anatomy and physiology. by S.R.Kale and R.R.Kale. A Manual of pharmaceutical biology practical byS.B.Gokhale, C.K.Kokate and S.P.Shriwastava. Biology practical manual according to Nationalcore curriculum .Biology forum of Karnataka. Prof .M.J.H.Shafi		
	Other References			

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: 2**
1	Course Code	BP 201T
2	Course Title	**Human Antomy & Physiology-II**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	1. Explain the gross morphology, structure and functions of various organsof the human body. 2. Describe the various homeostatic mechanisms and their imbalances. 3. Identify the various tissues and organs of different systems of humanbody. 4. Perform the hematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time etc and also record blood pressure, heart rate, pulseand respiratory volume. 5. Appreciate coordinated working pattern of different organs of eachsystem 6. Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.
6	Course Outcomes	**CO201.1**: The students will understand the structure and functions of various systems and organs of the body. Also about increase the understanding about genes and genetics. **CO201.2:** The student will be able to summarize the functioning of variousbody systems and their homeostasis. **CO201.3:** The student will be able to apply the knowledge of the functioningof various body systems and the structures of the organs involved in it. **CO201.4:** The students will analyze the correlation of various body systemsand how they result in particular kind of functions. **CO201.5:** The students would evaluate the processes like respiration, excretion, digestion hormone release and reproduction by understand their mechanisms.
7	Course Description	The subject covers the anatomy and physiology of different body parts andtheir interrelation to form various systems of the human body.
8	Outline syllabus	
	1	**UNIT-I** • **Nervous system** Organization of nervous system, neuron, neuroglia,classification and properties of nerve fibre,electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters. Central nervous system: Meninges, ventricles ofbrain and cerebrospinal fluid. structure and functions of brain (cerebrum, brainstem, cerebellum) ,spinal cord (gross structure,functions of afferent and efferent nervetracts, reflexactivity)
	2	**UNIT-II** • **Digestive system** Anatomy of GI Tract with special reference to anatomy and functions ofstomach,

<table>
<tr><td></td><td></td><td colspan="3">(Acid production in the stomach, regulation of acid production through parasympathetic nervous system,pepsinrole in protein digestion) small intestineand large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestionand absorption of nutrients and disorders of GIT.
• Energetics
Formation and role of ATP, Creatinine Phosphate and BMR.
• Joints
Structural and functional classification, types of joints movements and its articulation</td></tr>
<tr><td></td><td>3</td><td colspan="3">UNIT-III
• Respiratory system 10 hours
Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration
Lung Volumes and capacities transport of respiratory gases, artificialrespiration, and resuscitation methods.
• Urinary system
Anatomy of urinary tract with special reference to anatomy of kidney and nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidneyand disorders of kidney.</td></tr>
<tr><td></td><td>4</td><td colspan="3">UNIT-IV
• Endocrine system
Classification of hormones, mechanism of hormone action, structureand functions of pituitary gland, thyroid gland, parathyroid gland, adrenalgland, pancreas, pineal gland, thymus and their disorders.</td></tr>
<tr><td></td><td>5</td><td colspan="3">UNIT-V
• Reproductive system
Anatomy of male and female reproductive system, Functions of male and femalereproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition
• Introduction to genetics
Chromosomes, genes and DNA, protein synthesis, genetic pattern ofinheritance</td></tr>
<tr><td></td><td>Mode of examination</td><td colspan="3">Theory/Jury/Practical/Viva</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">Weightage Distribution</td><td>Continuous Mode Assessment</td><td>Sessional Exam</td><td>ESE</td></tr>
<tr><td>10 Marks</td><td>15</td><td>75</td></tr>
<tr><td></td><td>Text book/s*</td><td colspan="3">Practical human anatomy and physiology. byS.R.Kale and R.R.Kale.
A Manual of pharmaceutical biology practical byS.B.Gokhale, C.K.Kokate and S.P.Shriwastava.
Biology practical manual according to Nationalcore curriculum .Biology forum of Karnataka. ProfM.J.H.Shafi</td></tr>
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School:		**SOP**
Program:		**B.Pharma**
Branch:		**Semester: 2**
1	Course Code	BP202T
2	Course Title	**Pharmaceutical organic chemistry-I Theory**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the course the student shall be able to 1. Write the structure, name and the type of isomerism of the organic compound 2. Write the reaction, name the reaction and orientation of reactions. 3. Account for reactivity/stability of compounds. 4. Identify/ confirm the identification of organic compound.
6	Course Outcomes	**CO202.1**: The students will have the knowledge to identify, name, and write the structure of different aliphatic compounds and their derivatives. **CO202.2:** The students will be able to understand and explain the mechanism behind the naming reactions of different aliphatic compounds and their derivatives. **CO202.3:** The students can apply the knowledge to prepare the derivatives of aliphatic compounds with different functional groups. **CO202.4:** Students will analyze the chemical reactions, stabilities of organic compounds and properties of the compounds prepared by them in the laboratory. **CO202.5:** Students would evaluate bycomparing compounds prepared by them with standard compounds by chemical and physical properties
7	Course Description	General methods of preparation, assay for the compounds superscriptedwith asterisk (*), properties and medicinal uses of inorganic compoundsbelonging to the following classes Acids, Bases and Buffers: Buffer equations and buffer capacity in general, radiopharmaceuticals, their storage, handling and applications.
8	Outline syllabus	
	1	**UNIT-I** **Classification, nomenclature and isomerism** Classification of Organic Compounds Common and IUPAC systems of nomenclature of organic compounds Structural isomerisms in organic compounds
	2	**UNIT-II** **Alkanes*, Alkenes* and Conjugateddienes*** SP^3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins.

		Stabilization of alkenes, SP2 hybridization of alkenes. E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E1 verses E2 reactions, Factors affecting E1 and E2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions ofalkenes, Anti Markownikoff's orientation. Stability of conjugated dienes, Diel-Alder,electrophilic addition, free radical additionreactions of conjugated dienes, allylic rearrangement		
	3	**UNIT-III** **Alkyl halides*** SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN1 versus SN2 reactions, Factors affecting SN1 and SN2 reactions Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform. **Alcohols*-** Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol,chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol		
	4	**UNIT-IV** **Carbonyl compounds* (Aldehydes and ketones)** Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldolcondensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoincondensation, Perkin condensation, Qualitative tests of carbonyl compounds Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate,Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde.		
	5	**UNIT-V** **Carboxylic acids*** Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids ,amideand ester Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate,Methyl salicylate and Acetyl salicylic acid Aliphatic amines. Basicity, effect of substituents on basicity, identification test,Structure and uses of Ethanolamine,ehthylenediamine, amphetamine.		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	Practical human anatomy and physiology. by S.R.Kale and R.R.Kale. A Manual of pharmaceutical biology practical byS.B.Gokhale, C.K.Kokate and S.P.Shriwastava. Biology practical manual according to National core curriculum .Biology forum of Karnataka. Prof .M.J.H.Shafi		
	Other References			

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: 2**
1	Course Code	BP203 T
2	Course Title	**Biochemistry- Theory**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the course, the student shall be able to -Know the classification and salient features of five kingdoms of life -Understand the basic components of anatomy & physiology of plant -Know understand the basic components of anatomy & physiologyanimal with special reference to human
6	Course Outcomes	**CO203.1**: The students will understand the structure and functions of carbohydrate, lipids, nucleic acids, amino acids and proteins. Concept of free energy, endergonic and exergonic reaction, Relationship, between free energy. **CO203.2:**The student will be able to summarize the Citric acid cycle-Pathway, energetics and significance, HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency **CO203.3:** The student will be able to apply the knowledge of the Amino acid and lipid metabolism. **CO203.4:** The students will analyze the correlation ofNucleic acid metabolism and genetic information transfer. **CO203.5:** The students would Introduction, properties, nomenclature and IUB classification of enzymes, Enzyme kinetics (Michaelis plot, Line Weaver Burke plot).
7	Course Description	General methods of preparation, assay for the compounds superscriptedwith asterisk (*), properties and medicinal uses of inorganic compoundsbelonging to the following classes Acids, Bases and Buffers: Buffer equations and buffer capacity in general, radiopharmaceuticals, their storage, handling and applications.
8	Outline syllabus	
	1	**UNIT-I** • **Biomolecules and Bioenergetics** Topic1- Introduction, classification, chemical nature andbiological role of carbohydrate. Topic2- Introduction, classification, chemical nature andbiological rolelipids, nucleic acids,amino acids and proteins. Topic3-Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential. Energy rich compounds; classification; biologicalsignificances of ATP and cyclic AMP

	2	**UNIT-II** • **Carbohydrate metabolism and Biological oxidation** Topic 1- Glycolysis – Pathway, energetics and significance Citric acid cycle-Pathway, energetics and significance HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase(G6PD) deficiency Glycogen metabolismPathways and glycogen storage diseases (GSD). Topic 2- Gluconeogenesis- Pathway and its significance Hormonal regulation of blood glucose level and Diabetesmellitus Topic 3- Electron transport chain (ETC) and its mechanism. Oxidative phosphorylation & its mechanism and substrate Phosphorylation,Inhibitors ETC and oxidative phosphorylation/Uncouplrslevel		
	3	**UNIT-III** • **Lipid metabolism and Amino acid metabolism** β-Oxidation of saturated fatty acid (Palmitic acid) 61Formation and utilization of ketone bodies; ketoacidosisDe novo synthesis of fatty acids (Palmitic acid) Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis,fatty liver and obesity.General reactions of amino acid metabolism: (Phenyketonuria, Albinism, alkeptonuria, tyrosinemia) Synthesis and significance of biological substances; 5-HT,melatonin,dopamine,noradrenaline,adrenaline Catabolism of heme; hyperbilirubinemia and jaundice		
	4	**UNIT-IV** • **Nucleic acid metabolism and genetic informationtransfer** Topic1- Biosynthesis of purine and pyrimidine nucleotidesCatabolism of purine nucleotides andHyperuricemia and Gout disease Topic 2- Organization of mammalian genome Structure of DNA and RNA and their functionsDNA replication (semi conservative model) Topic 3- Transcription or RNA synthesis Genetic code, Translation or Protein synthesis andinhibitors 62		
	5	**UNIT-V** • **Enzymes** Topic 1- Introduction, properties, nomenclature and IUB classification of enzymes Enzyme kinetics (Michaelis plot, Line Weaver Burke plot)Enzyme inhibitors with examples Topic 2- Regulation of enzymes: enzyme induction andrepression, allosteric enzymes regulation Topic 3- Therapeutic and diagnostic applications of enzymes and isoenzymes, Coenzymes –Structure andbiochemical functions		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	Practical human anatomy and physiology. by S.R.Kale and		

		R.R.Kale. A Manual of pharmaceutical biology practical byS.B.Gokhale, C.K.Kokate and S.P.Shriwastava. Biology practical manual according to Nationalcore curriculum .Biology forum of Karnataka. ProfM.J.H.Shafi

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: 2**
1	Course Code	BP204T
2	Course Title	Pathophysiology- Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	1. To distinguish between environmental factors, physical, psychosocial, and cognitive characteristics of various diseases and conditions. 2. To understand basic concepts of inflammatory diseases 3. To Demonstrate and understand mechanisms of diseases, the diagnosisof diseases, and the treatment of diseases 4. To understand how the various organ systems are interrelated, and use this understanding to promote a holistic approach towards the evaluation and treatment of patients
6	Course Outcomes	CO 204.1: Distinguish environmental factors, physical, psychosocial, and cognitive characteristics of various diseases and conditions. CO204.2: Basic understanding of concepts and elements of inflammatory diseases CO204.3: Demonstrate an understanding of the mechanisms of diseases, the diagnosis of diseases, and the treatment of diseases CO204.4: Students will understand how the various organ systems are interrelated, and use this understanding to promote a holistic approachtowards the evaluation and treatment of patients CO 204.5: Students will be able to compare and discriminate between the infectious and sexually transmitted diseases.
7	Course Description	Pathophysiology is the study of causes of diseases and reactions of the body to such disease producing causes.This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications, and understanding of basic pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge required to practice medicine safely, confidently, rationally and effectively.
8	Outline syllabus	
	1	**UNIT-I** **Basic principles of Cell injury and Adaptation & Basic mechanism involved in the process of inflammation and repair** Causes of cellular injury,Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, Nuclear damage). Morphology of cell injury – Adaptive changes (Atrophy,

		Hypertrophy, hyperplasia, Metaplasia, Dysplasia), Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis& Alkalosis, Electrolyte imbalance. Introduction, Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis		
	2	**UNIT-II** **Cardiovascular, Respiratory and Renal Diseases** Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis) Asthma, Chronic obstructive airways diseases.Acute and chronic renal failure		
	3	**UNIT-III** **Hematological, Endocrine, Nervous and GIT diseases** Iron deficiency, megaloblastic anemia (Vit B12 and folicacid), sickle cell anemia, thalasemia, hereditary acquiredanemia, haemophilia Diabetes, thyroid diseases, disorders of sex hormones &Peptic ulcer Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease.		
	4	**UNIT-IV** **Cancer and inflammatory diseases** Classification, etiology and pathogenesis of cancer Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease. Rheumatoid arthritis, osteoporosis and gout		
	5	**UNIT-V** **Infectious & Sexually transmitted diseases (STDs)** Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infections AIDS, Syphilis & Gonorrhea		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	Practical human anatomy and physiology. by S.R.Kale and R.R.Kale. A Manual of pharmaceutical biology practical by S.B.Gokhale, C.K.Kokate and S.P.Shriwastava. Biology practical manual according to National core curriculum .Biology forum of Karnataka. Prof .M.J.H.Shafi		
	Other References			

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: II**
1	Course Code	BP205T
2	Course Title	Computer applications in Pharmacy- Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the course the student shall be able to know the various types of application of computers in pharmacy know the various types of databases know the various applications of databases in pharmacy
6	Course Outcomes	Upon completion of the course, the student shall be able to understand CO205.1 the Binary number system CO205.2 the web technologies CO205.3 the application of computers in Pharmacy CO205.4 the Bioinformatics Databases, Concept of Bioinformatics CO205.5 Computers as data analysis in Preclinical development:
7	Course Description	General methods of preparation, assay for the compounds superscriptedwith asterisk (*), properties and medicinal uses of inorganic compoundsbelonging to the following classes Acids, Bases and Buffers: Buffer equations and buffer capacity in general, radiopharmaceuticals, their storage, handling and applications.
8	Outline syllabus	
	1	**UNIT-I** **Number system**: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement, Two's complement method, binary multiplication, binary division
	2	**UNIT-II** **Webtechnologies**: Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and Server Products. Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database
	3	**UNIT-III** **Application of computers in Pharmacy** – Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System
	4	**UNIT-IV** **Bioinformatics:** Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine

		Discovery		
	5	**UNIT-V** **Computers as data analysis in Preclinical development**: Chromatographic dada analysis(CDS), Laboratory Information management System (LIMS) and Text Information Management System(TIMS)		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10	15	75
	Text book/s*	1. Computer Application in Pharmacy – William E.Fassett –Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330. 2. Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley-Interscience, A John Willey and Sons, INC., Publication, USA 3. Bioinformatics (Concept, Skills and Applications) – S.C.Rastogi-CBS Publishers andDistributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA) 4. Microsoft office Access - 2003, Application Development Using VBA, SQL Server,DAP and Infopath – Cary N.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi - 110002		
	Other References			

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: II**
1	Course Code	BP206 T
	Course Title	**Environmental Sciences (Theory)**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the course the student shall be able to**:** Create the awareness about environmental problems among learners. Impart basic knowledge about the environment and its allied problems. Develop an attitude of concern for the environment. Motivate learner to participate in environment protection and environment improvement. Acquire skills to help the concerned individuals in identifying and solving environmental problems. Strive to attain harmony with Nature.
6	Course Outcomes	
7	Course Description	General methods of preparation, assay for the compounds superscripted with asterisk (*), properties and medicinal uses of inorganic compoundsbelonging to the following classes Acids, Bases and Buffers: Buffer equations and buffer capacity in general, radiopharmaceuticals, their storage, handling and applications.
8	Outline syllabus	
	1	**UNIT-I** The Multidisciplinary nature of environmental studies Natura lResources Renewable and non-renewable resources: Natural resources and associated problems (a)Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.
	2	**UNIT-II** Ecosystems 1. Concept of an ecosystem. 2. Structure and function of an ecosystem. Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries
	3	**UNIT-III**

		Environmental Pollution: Air pollution; Water pollution; Soil pollution		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10	15	75
	Text book/s*	1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers,Bangalore 2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner. 3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd.,Ahmedabad – 380 013, India, 4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p 5. Clark R.S., Marine Pollution, Clanderson Press Oxford 6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p 7. De A.K., Environmental Chemistry, Wiley Eastern Ltd. 8. Down of Earth, Centre for Science and Environment		

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: 2**
1	Course Code	BP207 P
2	Course Title	**Human Anatomy & Physiology-II Practical**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	Upon completion of the course, the student shall be able to -Know the classification and salient features of five kingdoms of life -Understand the basic components of anatomy & physiology of plant -Know understand the basic components of anatomy & physiologyanimal with special reference to human
6	Course Outcomes	**CO101.1**: The students will understand the structure and functions of various tissues andorgans of the body. Also correlate their relevance with each other. **CO101.2:** The student will be able to summarize the functioning of various body systemsand their homeostasis. **CO101.3:** The student will be able to apply the knowledge of the anatomy and physiology of different body parts in explaining the working patterns of different body systems. **CO101.4:** The students will analyze the structures of various tissues and their origin toevaluate their damage and repair process. **CO101.5:** The students would evaluate the mechanisms of various processes on which thefunctioning of the various body organs depend. Moreover, will observe the anatomical differentiation of different body parts.
7	Course Description	Practical physiology is complimentary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussedin theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject**.**
8	Outline syllabus	
	1	**UNIT-I** To study the integumentary and special senses, nervous system, endocrine systemusing specimen, models, etc
	2	**UNIT-II** To demonstrate the general neurological examination. To demonstrate the function of olfactory nerve, different types of taste, visual acuity, reflex activity. Recording of body temperature
	3	**UNIT-III** To demonstrate positive and negative feed back mechanism.Determination of tidal volume and vital Capacity.

	4	**UNIT-IV** Study of digestive, respiratory, cardiovascular systems, urinary and reproductivesystem with the help of models, charts and specimens. Recording of basal mass index		
	5	**UNIT-V** Study of family planning devices and pregnancy diagnosistest. Demonstration of total blood count by cell analyser Permanent slides of vital organs and gonads.		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		05	10	35
	Text book/s*	1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypeebrothers medical publishers, New Delhi. 2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, ChurchillLivingstone, New York 3. Physiological basis of Medical Practice-Best and Tailor. Williams & WilkinsCo,Riverview,MI USA		
	Other References			

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: 2**
1	Course Code	BP208 P
2	Course Title	**Pharmaceutical organic chemistry-I Practical**
3	Credits	2
4	Contact Hours (L-T-P)	4
	Course Type	Compulsory
5	Course Objective	This subject deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.
6	Course Outcomes	**CO208.1P** Students will discover practical laboratory skills and get hands-on training of systematic qualitative analysis of organic compounds. **CO208.2P** Students will receive knowledge and understanding of systematic qualitative analysis of organic compounds and will be able to apply this knowledge in identification of organic compounds. **CO208.3P** Students will be able to prepare the solid derivatives of organic compounds and can apply this knowledge for the identification of drugs and pharmaceuticals also use these skills to modify various characteristicsof drugs and pharmaceuticals. **CO208.4P** Students will analyze professional transferable skills asexemplified by problem solving and teamwork. **CO208.5P** Students will get the skills for the predicting the atomic structureof drugs and chemicals
7	Course Description	Systematic qualitative analysis of unknown organic compounds like Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc. Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne'stest. Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides. Melting point/Boiling point of organic compounds Identification of the unknown compound from the literature Using meltingpoint/ boiling point Preparation of the derivatives and confirmation of the unknown compoundby melting point/ boiling point. Minimum 5 unknown organic compounds to be analyzed systematically. Preparation of suitable solid derivatives from organic compounds Construction of molecular models
8	Outline syllabus	
	1	**UNIT-I**

		I. Experiments involving preliminary test: Color, odour,aliphatic/aromatic compounds, saturation and unsaturation,etc. Physical characteristics Flame Test Bromine Test		
	2	**UNIT-II** **Element Detection (**Lassaigne's test)		
	3	**UNIT-III** **Solubility test**		
	4	**UNIT-IV** **Functional group test** like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.		
	5	**UNIT-V** Melting point/Boiling point of organic compounds Preparation of suitable solid derivatives fromorganic compounds Construction of molecular models		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		05	10	35
	Text book/s*	1. Organic Chemistry by Morrison and Boyd 2. Organic Chemistry by I.L. Finar , Volume-I 3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl. 4. Organic Chemistry by P.L.Soni 5. Practical Organic Chemistry by Mann and Saunders. 6. Vogel's text book of Practical Organic Chemistry 7. Advanced Practical organic chemistry by N.K.Vishnoi. 8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz. 9. Reaction and reaction mechanism by Ahluwaliah/Chatwal.		
	Other References			

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: 2**
1	Course Code	BP 209 P
2	Course Title	Biochemistry Practical
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	Upon completion of course student shall able to Understand the catalytic role of enzymes, importance of enzyme inhibitors indesign of new drugs, therapeutic and diagnostic applications of enzymes. Understand the metabolism of nutrient molecules in physiological and pathological conditions. Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.
6	Course Outcomes	**CO209.1** Students will do the Qualitative analysis of carbohydrates **CO209.2** Students will do the Quantitative analysis of carbohydrates **CO209.3** Students will be able to determine creatinine **CO209.4** Students will be able to determine serum cholesterol **CO209.5** Students will be able to determine amino acids by Paper Chromatographic Technique.
7	Course Description	Biochemistry deals with complete understanding of the molecular levels of the chemical process associated with living cells. The scope of the subject is providingbiochemical facts and the principles to understand metabolism of nutrient molecules in physiological and pathological conditions. It is also emphasizing on genetic organization of mammalian genome and hetero & autocatalytic functions of DNA.
8	Outline syllabus	
	1	**UNIT-I** Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch) Identification tests for Proteins (albumin and Casein)
	2	**UNIT-II** Quantitative analysis of reducing sugars (DNSA method) and Proteins(Biuret method) Qualitative analysis of urine for abnormal constituents
	3	**UNIT-III** Determination of blood creatinine Determination of blood sugar
	4	**UNIT-IV** Determination of serum total cholesterol Preparation of buffer solution and measurement of pH
	5	**UNIT-V**

		Study of enzymatic hydrolysis of starch Determination of amino acids by Paper Chromatographic Technique.		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		05	10	35
	Text book/s*	Practical Biochemistry by R.C. Gupta and S. Bhargavan. Introduction of Practical Biochemistry by David T. Plummer.(3rd Edition) Practical Biochemistry for Medical students by Rajagopal and Ramakrishna. Practical Biochemistry by Harold Varley		
	Other References			

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: 2**
1	Course Code	BP210 P
2	Course Title	**Computer applications in Pharmacy- Practical**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	Upon completion of the course the student shall be able to know the various types of application of computers in pharmacy know the various types of databases know the various applications of databases in pharmacy
6	Course Outcomes	Upon completion of the course, the student shall be able to understand CO210.1 the Binary number system CO210.2 the web technologies CO210.3 the application of computers in Pharmacy CO210.4 the Bioinformatics Databases, Concept of Bioinformatics CO210.5 Computers as data analysis in Preclinical development:
7	Course Description	Design a questionnaire using a word processing package to gather information about a particular disease. Create a HTML web page to show personal information. Retrieve the information of a drug and its adverse effects using online tools Creating mailing labels Using Label Wizard , generating label in MS WORD Create a database in MS Access to store the patient information with the required fields Using access Design a form in MS Access to view, add, delete and modify the patient record in the database Generating report and printing the report from patient database Creating invoice table using – MS Access Exporting Tables, Queries, Forms and Reports to XML pages
8	Outline syllabus	
	1	**UNIT-I** **Number system**: Binary number system, Decimal number system, Octalnumber system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement, Two's complement method, binary multiplication, binary division
	2	**UNIT-II** **Webtechnologies**: Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and ServerProducts Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database
	3	**UNIT-III** **Application of computers in Pharmacy** – Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and

		Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring Diagnostic System, Lab-diagnostic System, Patient Monitoring System,Pharma Information System		
	4	**UNIT-IV** **Bioinformatics:** Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery		
	5	**UNIT-V** **Computers as data analysis in Preclinical development**: Chromatographic dada analysis (CDS), Laboratory Information managementSystem (LIMS) and Text Information Management System (TIMS)		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10	15	75
	Text book/s*	1.Computer Application in Pharmacy – William E.Fassett –Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330. 2.Computer Application in Pharmaceutical Research and Development –Sean Ekins –Wiley-Interscience, A John Willey and Sons, INC., Publication, USA 3.Bioinformatics (Concept, Skills and Applications) – S.C.Rastogi-CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA) 4.Microsoft office Access - 2003, Application Development Using VBA, SQL Server,DAP and Infopath – Cary N.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi - 110002		
	Other References			

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: 3**
1	Course Code	BP301 T
	Course Title	Pharmaceutical organic chemistry-II- Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the course the student shall be able to 1. write the structure, name and the type of isomerism of the organic compound 2. write the reaction, name the reaction and orientation of reactions 3. account for reactivity/stability of compounds, 4. prepare organic compounds
6	Course Outcomes	CO301.1:The students will have the knowledge to identify, name, and writethe structure of different aromatic compounds and their derivatives. CO301.2: The students will be able to understand and explain the mechanism behind the naming reactions of different aromatic compounds and their derivatives. CO301.3: The students can apply the knowledge to prepare the derivativesof aromaic compounds with different fuctional groups. CO301.4: Students will analyze the chemical reactions, stabilities of organic compounds and properties of the compounds prepared by them in the laboratory. CO301.5: Students would evaluate bycomparing compounds prepared bythem with standard compounds by chemical and physical properties.
7	Course Description	This subject deals with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds are also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. Chemistry of fats and oils are also included in the syllabus.
8	Outline syllabus	
	1	**UNIT-I** **Benzene and its derivatives** Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedelcrafts alkylation- reactivity, limitations, Friedelcrafts acylation. Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction Structure and uses of DDT, Saccharin, BHC and Chloramine

	2	**UNIT-II** **Phenols*** - Acidity of phenols, effect of substituents on acidity, qualitativetests, Structure and uses of phenol, cresols, resorcinol, naphthols **Aromatic Amines* -** Basicity of amines, effect of substituents on basicity,and synthetic uses of aryl diazonium salts **Aromatic Acids* –**Acidity, effect of substituents on acidity andimportant reactions of benzoic acid.
	3	**UNIT-III** Fatty acids – reactions. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.
		UNIT-IV **Polynuclear hydrocarbons:** Synthesis, reactions Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives
		UNIT-V **Cyclo alkanes*** Stabilities – Baeyer's strain theory, limitation of Baeyer's strain theory,Coulson and Moffitt's modification, Sachse Mohr's theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only
	Mode of examination	Theory/Jury/Practical/Viva
	Weightage Distribution	**Continuous Mode Assessment** | Sessional Exam | ESE 10 | 15 | 75
	Text book/s*	1. Organic Chemistry by Morrison and Boyd 2. Organic Chemistry by I.L. Finar , Volume-I 3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl. 4. Organic Chemistry by P.L.Soni 5. Practical Organic Chemistry by Mann and Saunders. 6. Vogel's text book of Practical Organic Chemistry 7. Advanced Practical organic chemistry by N.K.Vishnoi.

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: 3**
1	Course Code	BP302
2	Course Title	**Physical Pharmaceutics I- Theory**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon the completion of the course student shall be able to 1. Understand various physicochemical properties of drug molecules in the designing the dosage forms 2. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms. 3. Apply the concept of surface tension and surfactants in formulation and development.
6	Course Outcomes	CO302.1: Students would be able to understand the concept of solubility, solutions, diffusion, CST , distribution and apply them in formulation, development and biological systems. CO302.2: Students would be able to explain the basics of states of matter and physical properties of drugs and use them in pharmaceutical field. CO302.3: Students would be able to apply the basics of surface and interfacial tension, surface active agents, HLB and adsorption in formulation and development of pharmaceutical systems. CO302.4: Students would be able to describe Complexation, protein binding and relate it with drug action. CO302.5: Students would be able to compare methods of determination of pH and demonstrate the applications of buffered isotonic solutions in pharmaceutical and biological systems.
7	Course Description	The course deals with the various physica and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.
8	Outline syllabus	
	1	**UNIT-I** **Solubility of drugs:** Solubility expressions, mechanisms of solute solvent

		interactions,ideal solubility parameters, solvation & association, quantitative approach to the factorsinfluencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications		
	2	**UNIT-II** **States of Matter and properties of matter:**State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid-crystalline, amorphous & polymorphism. **Physicochemical properties of drug molecules:** Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications		
	3	**UNIT-III** **Surface and interfacial phenomenon:** Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB Scale, solubilisation,detergency, adsorption at solid interface.		
	4	**UNIT-IV** **Complexation and protein binding:** Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants.		
	5	**UNIT-V** **pH, buffers and Isotonic solutions:** Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions.		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	Physical Pharmacy by Alfred Martin Experimental Pharmaceutics by Eugene, Parott. Tutorial Pharmacy by Cooper and Gunn.		

		Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to3, MarcelDekkar Inc. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Dispersesystems, volume 1, 2, 3. Marcel Dekkar Inc.

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: 3**
1	Course	BP303 T
2	Course Title	Pharmaceutical Microbiology- Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the course the student shall be able to tell about the history, scope of microbiology and describe the structure, morphology and cultivation of microorganism. Student shall identify the bacteria on the basis of various staining technique and importance of sterilization in microbiology. Upon completion of the course the student shall understand the various methods for assessment of antibiotic, test for sterility for preparation. Student shall analyze the source of contamination and their prevention inaseptic areas and importance of cell culture technique.
6	Course Outcomes	CO303.1: Students shall have knowledge about history of microbiology, its scope, branches, structure of bacteria, their nutrient requirements, growth curve, their isolation preservation and measurement, application of various kind of microscopy. CO303.2: Students shall be able the differentiate the types of bacteria on the basis of staining technique and biochemical test and with different typeof microscopic technique, they will understand the concept of sterilization, equipment used and their method of validation CO303.3: Students shall acquire complete knowledge of microorganism(viruses, fungi) like classification reproduction pattern, disinfection and antiseptic their evaluation methods and about sterility testing of variouspharmaceutical products. CO303.4: Students can apply their knowledge to design the aseptic area and standardization of antibiotic, biomolecules. CO303.5: Students will be able to analyze the sources of contamination and their preventions in pharmaceutical products, and they will understand the concept of animal cell in culture and their application in pharmaceutical industry and research.
7	Course Description	Study of all categories of microorganisims especially for the production of alchol antibiotics, vaccines, vitamins enzymes etc..
8	Outline syllabus	

	1	**UNIT-I** Introduction, history of microbiology, its branches, scope and its importance. Introduction to Prokaryotes and Eukaryotes Study of ultra-structure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement ofbacterial growth (total & viable count). Study of different types of phase constrast microscopy, dark field microscopy and electron microscopy.		
	2	**UNIT-II** Identification of bacteria using staining techniques (simple, Gram's & Acidfast staining) and biochemical tests (IMViC). Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous, radiation and mechanical method of sterilization. Evaluation of the efficiency of sterilization methods.		
	3	**UNIT-III** Study of morphology, classification, reproduction/replicationandcultivation of Fungi and Viruses. Classification and mode of action of disinfectants Factors influencing disinfection, antiseptics and their evaluation. Forbacteriostatic and bactericidal actions Evaluation of bactericidal & Bacteriostatic. Sterility testing of products (solids, liquids, ophthalmic and other sterileproducts) according to IP, BP and USP.		
	4	**UNIT-IV** Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification. Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic.		
	5	**UNIT-V** Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage. Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations.		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75

	Text book/s*	1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientificpublications, Oxford London. 2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors,Delhi. 3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn. 4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology. 5. Rose: Industrial Microbiology. 6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan 7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution. 8. Peppler: Microbial Technology. 9. I.P., B.P., U.S.P.- latest editions. 10. Ananthnarayan : Text Book of Microbiology, Orient-Longman, Chennai 11. Edward: Fundamentals of Microbiology. 12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi 13. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: 3**
1	Course Code	BP 304 T
2	Course Title	**Pharmaceutical Engeneering - Theory**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the course student shall be able: To know various unit operations used in Pharmaceutical industries. To understand the material handling techniques. To perform various processes involved in pharmaceutical manufacturing process. To carry out various test to prevent environmental pollution. To appreciate and comprehend significance of plant lay out design for optimum use of resources. To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.
6	Course Outcomes	**CO304.1**: Students will be able to describe about various unit operations used in pharmaceutical industries. They will be able to enumerate about flow of fluids. They will gain an insight on principle and equipment of size reduction and size separation and their applications in pharmaceutical field. **CO304.2:** Students will be able to understand about basic concepts and importance of various heat transfer methods involved in pharmaceutical filed. They would develop an understanding of equipments and pharmaceutical applications of evaporation and distillation. **CO304.3:** Students will be able to illustrate about the concepts, equipments and pharmaceutical applications of drying and mixing. **CO304.4:** Students will be able to distinguish between different types of equipments used in various unit operations such as filtration and centrifugation. **CO304.5:** Students will be able to predict about various materials used in pharmaceutical plant construction, types of corrosion and its prevention methodsand basics of material handling system
7	Course Description	This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industryand their importance in day to day running of a pharmaceutical unit is emphasized to the students.
8	Outline syllabus	
	1	**UNIT-I** **Flow of fluids:** Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer.

		Size Reduction: Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill. **Size Separation:** Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.
	2	**UNIT-II** **Heat Transfer:** Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers. **Evaporation:** Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator& Economy of multiple effect evaporator. **Distillation:** Basic Principles and methodology of simple distillation,flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation
	3	**UNIT-III** **Drying:** Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer. **Mixing:** Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demeritsof Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles & Silverson Emulsifier,
	4	**UNIT-IV** **Filtration:** Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter. **Centrifugation:** Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.
	5	**UNIT-V** **Pharma Materials of pharmaceutical plant construction, Corrosion and its prevention:** Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic non metals, basic of material handling systems.

	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. Introduction to chemical engineering – Walter L Badger & Julius Banchero, Latestedition. 2. Solid phase extraction, Principles, techniques and applications by Nigel J.K. Simpson-Latest edition. 3. Unit operation of chemical engineering – Mcabe Smith, Latest edition. 4. Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latestedition. 5. Remington practice of pharmacy- Martin, Latest edition. 6. Theory and practice of industrial pharmacy by Lachmann., Latest edition. 7. Physical pharmaceutics- C.V.S Subrahmanyam et al., Latest edition. 8. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.		

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: 3**
1	Course Code	BP305 P
	Course Title	**Pharmaceutical organic chemistry II – Practical**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	Upon completion of the course the student shall be able to**:** Create the awareness about environmental problems among learners. Impart basic knowledge about the environment and its allied problems. Develop an attitude of concern for the environment. Motivate learner to participate in environment protection and environment improvement. Acquire skills to help the concerned individuals in identifying and solving environmental problems. Strive to attain harmony with Nature.
6	Course Outcomes	CO305.1:The students will have the knowledge to identify, name, and writethe structure of different aromatic compounds and their derivatives. CO305.2: The students will be able to understand and explain the mechanism behind the naming reactions of different aromatic compounds and their derivatives. CO305.3: The students can apply the knowledge to prepare the derivativesof aromaic compounds with different fuctional groups. CO305.4: Students will analyze the chemical reactions, stabilities of organic compounds and properties of the compounds prepared by them in the laboratory. CO301.5: Students would evaluate bycomparing compounds prepared bythem with standard compounds by chemical and physical properties. CO301.6:The students can plan to prepare new derivatives based on theabove knowledge.
7	Course Description	Experiments involving laboratory techniques Recrystallization Steam distillation Determination of following oil values (including standardization ofreagents) Acid value Saponification value Iodine value **Preparation Of Compounds** Benzanilide/Phenyl benzoate/Acetanilide from Aniline/Phenol/Aniline by acylation reaction. 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/ Acetanilide by halogenation (Bromination) reaction. 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid /Nitro benzene

		by nitration reaction. Benzoic acid from Benzyl chloride by oxidation reaction. Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate byhydrolysis reaction. 1-Phenyl azo-2-napthol from Aniline by diazotization and couplingreactions. Benzil from Benzoin by oxidation reaction. Dibenzal acetone from Benzaldehyde by Claison Schmidt reaction Cinnammic acid from Benzaldehyde by Perkin reaction *P*-Iodo benzoic acid from *P*-amino benzoic acid
8	Outline syllabus	
	1	**Experiments involving laboratory techniques** Recrystallization Steam distillation Derivatives of benzene
	2	**Deterination of following oil values** Acid value Saponification value Iodine value
	3	**III Preparation of compound** Benzil Phenyl benzoate Benzoic acid Oxalic acid and Rancidity of oils, Drying oils. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.
	Mode of examination	Theory/Jury/Practical/Viva
	Weightage Distribution	**Continuous Mode Assessment** | Sessional Exam | ESE 10 | 15 | 75
	Text book/s*	1. Organic Chemistry by Morrison and Boyd 2. Organic Chemistry by I.L. Finar , Volume-I 3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl. 4. Organic Chemistry by P.L.Soni 5. Practical Organic Chemistry by Mann and Saunders. 6. Vogel's text book of Practical Organic Chemistry 7. Advanced Practical organic chemistry by N.K.Vishnoi.

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: 3**
1	Course Code	BP306 P
2	Course Title	**Physical pharmaceutics I-Practical**
3	Credits	4
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	Upon the completion of the course student shall be able to Understand various physicochemical properties of drug molecules in the designing the dosage forms Demonstrate use of physicochemical properties in the formulationdevelopment and evaluation of dosage forms.
6	Course Outcomes	**CO306P.1:** The students would be able to describe the various methods of determination of physicochemical properties of drugs and pharmaceuticals. **CO306P.2:** The students would be able to demonstrate methods for determination of HLB value and Critical Micelle concentration of surfactants. **CO306P.3:** The students would be able to calculate the value of stability constants in complexation by various methods. **CO306P.4:** The students would be able to compare various methods of determination of stability constants and understand the effect of addition ofsalt on CST of the system. **CO306P.4:** The students would be able to determine of Freundlich and Langmuirconstants
7	Course Description	Determination of physicochemical properties of drugs and pharmaceuticalsand determination of stability constants, adsorption constants , HLB and CMC values.
8	Outline syllabus	
	1	**To determine various physicochemical properties of drugs and Pharmaceuticals** Determination of solubility of drug at room temperature Determination of pKa value byHalf Neutralization/ Henderson Hasselbalchequation. Determination of Partition co- efficient ofbenzoic acid in benzene and water Determination of Partition co- efficient ofIodine in CCl4 and water Determination of surface tensionof givenliquids by drop count and drop weight methods
	2	**To Determine importants parameter of Surfactants** Determination of HLB number of a surfactantby saponification method Determination of critical micellarconcentration of surfactants
	3	**To determine stability constants of complexation by various methods** Determination of stability constant and donoracceptor ratio of PABA-Caffeine complex bysolubility method.

		Determination of stability constant and donoracceptor ratio of Cupric-Glycine complex by pH titration method		
	4	**To study the effect of addition of salt CST and to determine adsorption constants** Determination of % composition of NaCl in a solution using phenol-water system by CST method. Determination of Freundlich and Langmuirconstants using activated char coal		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	Physical Pharmacy by Alfred Martin Experimental Pharmaceutics by Eugene, Parott. Tutorial Pharmacy by Cooper and Gunn. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to3, MarcelDekkar Inc. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Dispersesystems, volume 1, 2, 3. Marcel Dekkar Inc. Physical Pharmaceutics by Ramasamy C and ManavalanR. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee Physical Pharmaceutics by C.V.S. Subramanyam Test book of Physical Phramacy, by Gaurav Jain & Roop K. Khar		
	Other References			

School:		**SOP**		
Program:		**B. Pharm**		
Branch:		**Semester: 3**		
1	Course Code	BP307 P		
2	Course Title	Pharmaceutical microbiology Practical		
3	Credits	2		
4	Contact Hours (L-T-P)	0-0-4		
	Course Type	Compulsory		
5	Course Objective	Upon completion of the course the student shall be able to tell about the history, scope of microbiology and describe the structure, morphology and cultivation of microorganism. Student shall identify the bacteria on the basis of various staining technique and importance of sterilization in microbiology. Upon completion of the course the student shall understand the various methods for assessment of antibiotic, test for sterility for preparation. Student shall analyze the source of contamination and their prevention inaseptic areas and importance of cell culture technique.		
6	Course Outcomes	CO307.1: Students shall have knowledge about the various equipment used in experimental microbiology and understand the principle and working of these instruments. CO307.2: Students shall be able to understand the importance of sterilization in microbiology and apply this knowledge for the preparationof various media. CO307.3: Students shall acquire complete knowledge of isolation procedure of microorganism (viruses, fungi) and will be able to differentiate microorganism on the basis of various staining technique CO307.4: Students can apply their knowledge for the standardization ofantibiotics.		
7	Course Description	To emphasize on definition, types, classification, principles/mechanisms,applications, examples and differences		
8	Outline syllabus			
	1	To study various equipment used in microbiology To perform the sterilization of glassware by moistheat and dry heat		
	2	Preparation of sterile nutrient broth Preparation of sterile nutrient agar media		
	3	Study of environmental microflora of various region		
	4	Standardization of antibiotic by cup and plate method Identification of bacteria by gram staining technique identification of bacteria by acid fast staining technique Preparation of nutrient slant and stab culture		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		05	10	35
	Text book/s*	1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific		

		publications, Oxford London. 2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors,Delhi. 3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn. 4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology. 5. Rose: Industrial Microbiology. 6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan 7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution. 8. Peppler: Microbial Technology. 9. I.P., B.P., U.S.P.- latest editions. 10. Ananthnarayan : Text Book of Microbiology, Orient-Longman, Chennai 11. Edward: Fundamentals of Microbiology. 12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi 13. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company
	Other References	

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: 3**
1	Course Code	BP 308 P
2	Course Title	**Pharmaceutical Engineering Practical**
3	Credits	4
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	Upon completion of the course student shall be able: To know various unit operations used in Pharmaceutical industries. To understand the material handling techniques. To perform various processes involved in pharmaceutical manufacturing process. To carry out various test to prevent environmental pollution. To appreciate and comprehend significance of plant lay out design for optimum use of resources. To appreciate the various preventive methods used for corrosion control in pharmaceutical industries.
6	Course Outcomes	**CO308.1** Upon completion of course student shall be able to tell the different factors effecting rate of filtration, evaporation and overall heat transfer coefficient etc. They will also able to describe construction, working and principle of Pharmaceutical Machinery. **CO308.2** Students shall be able to predict humidity of air, effect of time on crystallizationrate and laws of size reduction. **CO308.3** Students shall be able to calculate uniformity index of given sample, effiecency of steam distillation and construct various size frequency curves, drying curves etc. **CO308.4** Students shall be able to evaluate size distribution of tablet granulations. **CO308.5** Students shall be able to calculate time of crystallisation
7	Course Description	This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industryand their importance in day to day running of a pharmaceutical unit is emphasized to the students.
8	Outline syllabus	
	1	Students would be able to determine the overall heat transfer coefficient by heat exchanger and calculate the efficiency of steam distillation. Students would be able to construct drying curves (for calcium carbonate and starch) and determine moisture content and loss on drying.
	2	Students would be able to determine humidity of air – i) From wet and dry bulb temperatures –use of Dew point method. Students would be able to evaluate size distribution of tablet granulations by using sieving method
	3	Students would be able to verify the laws of size reduction using ball mill using

		Ball Mill Students would be able to relate factors affecting Rate of Evaporation and Filtration. Students would be able to understand the working of major equipment used in Pharmaceutical industry.		
	4	Students would be able to study the effect of time on the Rate of Crystallization Students would be able to calculate the uniformity Index for given sample by using Double Cone Blender		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. Introduction to chemical engineering – Walter L Badger & Julius Banchero, Latestedition. 2. Solid phase extraction, Principles, techniques and applications by Nigel J.K. Simpson-Latest edition. 3. Unit operation of chemical engineering – Mcabe Smith, Latest edition. 4. Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latestedition. 5. Remington practice of pharmacy- Martin, Latest edition. 6. Theory and practice of industrial pharmacy by Lachmann., Latest edition. 7. Physical pharmaceutics- C.V.S Subrahmanyam et al., Latest edition. 8. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.		

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: IV**
1	Course Code	BP401T
2	Course Title	Pharmaceutical Organic Chemistry III - Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the course the student shall be able to understand the methods of preparation and properties of organiccompounds explain the stereo chemical aspects of organic compounds and stereochemical reactions know the medicinal uses and other applications of organic compounds
6	Course Outcomes	**CO401.1**: Students shall be able to assign configuration to optical and geometrical isomers. They also get the knowledge of properties of enantiomers and geometrical isomers and diasteriomers. **CO401.2:** Students shall acquire the knowledge of separation of different isomers and on the basis of this knowledge students can separate the desiredisomeric form. **CO401.3:** Students shall be able to do nomenclature of heterocycliccompound and draw the structure of heterocyclic compounds. **CO401.4:** students shall gain the knowledge of various heterocycliccompounds in terms of their synthesis, chemical reactions and their applications in medicines. **CO401.5:** The students will be able to understand and explain the mechanism behind various naming reactions and acquired the knowledge oftheir applications in preparation of various drugs and intermediates.
7	Course Description	General methods of preparation and reactions of compounds superscriptedwith asterisk (*) to be explained. **08 Hours** **UNIT-I** **Stereo isomerism** Optical isomerism – Optical activity, enantiomerism, diastereoisomerism, meso compounds Elements of symmetry, chiral and achiral molecules DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers Reactions of chiral molecules Racemic modification and resolution of racemic mixture.Asymmetric synthesis: partial and absolute

		UNIT-II Geometrical isomerism Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems) Methods of determination of configuration of geometrical isomers. Conformational isomerism in Ethane, n-Butane and Cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for opticalactivity. Stereospecific and stereoselective reactions **Unit III** **Heterocyclic compounds:** Nomenclature and classification Synthesis, reactions and medicinal uses of followingcompounds/derivatives Pyrrole, Furan, and Thiophene Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene **UNIT-IV** **8 Hours** Synthesis, reactions and medicinal uses of following compounds/derivativesPyrazole, Imidazole, Oxazole and Thiazole. Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives **UNIT-V** **Reactions of synthetic importance** Metal hydride reduction ($NaBH_4$ and $LiAlH_4$), Clemmensen reduction, Birchreduction, Wolff Kishner reduction. Oppenauer-oxidation and Dakin reaction. Beckmanns rearrangement and Schmidt rearrangement.Claisen-Schmidt condensation
8	Outline syllabus	
	1	**UNIT-I** **10 Hours** **Stereo isomerism** Optical isomerism –Optical activity, enantiomerism, diastereoisomerism, meso compounds

		Elements of symmetry, chiral and achiral molecules DL system of nomenclature of optical isomers, sequence rules, RS system ofnomenclature of optical isomersReactions of chiral molecules Racemic modification and resolution of racemic mixture.Asymmetric synthesis: partial and absolute
	2	**UNIT-II** **10 Hours** Geometrical isomerism Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems) Methods of determination of configuration of geometrical isomers. Conformational isomerism in Ethane, n-Butane and Cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. Stereospecific and stereoselective reactions
	3	**Unit III** **Heterocyclic compounds:** Nomenclature and classification Synthesis, reactions and medicinal uses of following compounds/derivativesPyrrole, Furan, and Thiophene Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene
	4	**UNIT-IV** **8 Hours** Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrazole, Imidazole, Oxazole and Thiazole. Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives
	5	**UNIT-V** **Reactions of synthetic importance** Metal hydride reduction ($NaBH_4$ and $LiAlH_4$), Clemmensen reduction, Birchreduction, Wolff Kishner reduction. Oppenauer-oxidation and Dakin reaction. Beckmanns rearrangement and Schmidt rearrangement.Claisen-Schmidt condensation

	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. Organic chemistry by I.L. Finar, Volume-I & II. 2. A text book of organic chemistry – Arun Bahl, B.S. Bahl. 3. Heterocyclic Chemistry by Raj K. Bansal 4. Organic Chemistry by Morrison and Boyd 5. Heterocyclic Chemistry by T.L. Gilchrist		
	Other References			

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: IV**
1	Course Code	BP402T
2	Course Title	Medicinal chemistry I - Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the course the student shall be able to 1. understand the chemistry of drugs with respect to their pharmacological activity 2. understand the drug metabolic pathways, adverse effect and therapeuticvalue of drugs 3. know the Structural Activity Relationship (SAR) of different class of drugs write the chemical synthesis of some drugs
6	Course Outcomes	CO402.1 The students will have the knowledge to identify, name andclassify the different categories of drugs with respect to their pharmacological activities. CO402.2 The students will understand and explain the structure activity relationship, drug metabolic pathways, adverse effects and their therapeutic activity of different categories of drugs. CO402.3 The students can apply the knowledge to construct the chemical synthesis of some drugs. CO402.4 The students will analyse chemical reactions, stabilities of compounds and properties of the compounds prepared by them in the laboratory. CO402.5 The students can evaluate the compounds prepared by them inthe laboratory.
7	Course Description	Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*) UNIT- I 10 Hours Introduction to Medicinal Chemistry History and development of medicinal chemistry Physicochemical properties in **relation to biological action** Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism.

Drug metabolism

Drug metabolism principles- Phase I and Phase II.

Factors affecting drug metabolism including stereo chemical aspects.

UNIT- II

10 Hours

Drugs acting on Autonomic Nervous System Adrenergic Neurotransmitters:

Biosynthesis and catabolism of catecholamine.

Adrenergic receptors (Alpha & Beta) and their distribution.

Sympathomimetic agents: SAR of Sympathomimetic agents

Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine,

Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline.

Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine,Propylhexedrine.

Agents with mixed mechanism: Ephedrine, Metaraminol.

Adrenergic Antagonists:

Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide.

Beta adrenergic blockers: SAR of beta blockers, Propranolol*,Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol,Labetolol, Carvedilol.

UNIT-III

10 Hours

Cholinergic neurotransmitters:

Biosynthesis and catabolism of acetylcholine.

Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.

Parasympathomimetic agents: SAR of Parasympathomimetic agents

Direct acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine.

Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion.

Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic Blocking agents: SAR of cholinolytic agents

Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.

Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

UNIT- IV

08 Hours

Drugs acting on Central Nervous System

Sedatives and Hypnotics:

Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem

Barbiturtes: SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital

Miscelleneous:

Amides & imides: Glutethmide.

Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol.Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

Antipsychotics

Phenothiazeines: SAR of Phenothiazeines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.

Ring Analogues of Phenothiazeines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.

Fluro buterophenones: Haloperidol, Droperidol, Risperidone.

Beta amino ketones: Molindone hydrochloride.

Benzamides: Sulpieride.

Anticonvulsants: SAR of Anticonvulsants**,** mechanism of anticonvulsant action

Barbiturates: Phenobarbitone, Methabarbital. **Hydantoins:**

Phenytoin*, Mephenytoin, Ethotoin **Oxazolidine diones:**

Trimethadione, Paramethadione **Succinimides:**

Phensuximide, Methsuximide, Ethosuximide* **Urea and monoacylureas**:

Phenacemide, Carbamazepine* **Benzodiazepines**: Clonazepam

Miscellaneous: Primidone, Valproic acid , Gabapentin, Felbamate

UNIT – V

07 Hours

Drugs acting on Central Nervous System

General anesthetics:

Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.

Ultra short acting barbitutrates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.

Dissociative anesthetics: Ketamine hydrochloride.*

Narcotic and non-narcotic analgesics

Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.

Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.

Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*,

		Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.
8	Outline syllabus	
	1	**UNIT- I** **10 Hours** **Introduction to Medicinal Chemistry** History and development of medicinal chemistry Physicochemical properties in relation to biological action Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism. **Drug metabolism** Drug metabolism principles- Phase I and Phase II. Factors affecting drug metabolism including stereo chemical aspects.
	2	**UNIT- II** **10 Hours** **Drugs acting on Autonomic Nervous SystemAdrenergic Neurotransmitters:** Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution. **Sympathomimetic agents: SAR of Sympathomimetic agents** Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline. • Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine,Propylhexedrine. • Agents with mixed mechanism: Ephedrine, Metaraminol. **Adrenergic Antagonists:** **Alpha adrenergic blockers:** Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide. **Beta adrenergic blockers:** SAR of beta blockers, Propranolol*,Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol,Labetolol, Carvedilol.

	3	**UNIT-III** **10 Hours** **Cholinergic neurotransmitters:** Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution. **Parasympathomimetic agents: SAR of Parasympathomimetic agents** **Direct acting agents:** Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine. **Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible):** Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion. **Cholinesterase reactivator:** Pralidoxime chloride. **Cholinergic Blocking agents: SAR of cholinolytic agents** **Solanaceous alkaloids and analogues:** Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*. **Synthetic cholinergic blocking agents:** Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*,Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.
	4	**UNIT- IV** **08 Hours** **Drugs acting on Central Nervous System** **Sedatives and Hypnotics:** **Benzodiazepines:** SAR of Benzodiazepines, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital **Miscelleneous:** Amides & imides: Glutethmide. Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol.Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

		Antipsychotics **Phenothiazeines:** SAR of Phenothiazeines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride. **Ring Analogues of Phenothiazeines:** Chlorprothixene, Thiothixene,Loxapine succinate, Clozapine. **Fluro buterophenones:** Haloperidol, Droperidol, Risperidone. **Beta amino ketones:** Molindone hydrochloride. **Benzamides:** Sulpieride. Chlordiazepoxide, Diazepam*,Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem **Barbiturtes:** SAR of barbiturates, Barbital*,
	5	**UNIT – V** **07 Hours** **Drugs acting on Central Nervous System** **General anesthetics:** **Inhalation anesthetics:** Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane. **Ultra short acting barbitutrates:** Methohexital sodium*, Thiamylal sodium, Thiopental sodium. **Dissociative anesthetics:** Ketamine hydrochloride.* **Narcotic and non-narcotic analgesics** **Morphine and related drugs:** SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate. **Narcotic antagonists:** Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride. **Anti-inflammatory agents:** Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone. Reactions of synthetic importance Metal hydride reduction ($NaBH_4$ and $LiAlH_4$), Clemmensen reduction, Birch

		reduction, Wolff Kishner reduction. Oppenauer-oxidation and Dakin reaction. Beckmanns rearrangement and Schmidt rearrangement. Claisen-Schmidt condensation		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry. 2. Foye's Principles of Medicinal Chemistry. 3. Burger's Medicinal Chemistry, Vol I to IV. 4. Introduction to principles of drug design- Smith and Williams. 5. Remington's Pharmaceutical Sciences. 6. Martindale's extra pharmacopoeia. 7. Organic Chemistry by I.L. Finar, Vol. II. 8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5. 9. Indian Pharmacopoeia. 10. Text book of practical organic chemistry- A.I.Vogel.		
	Other References			

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: IV**
1	Course Code	BP403T
2	Course Title	Physical Pharmaceutics II - Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon the completion of the course student shall be able to 1. Understand various physicochemical properties of drug molecules in the designing the dosage form 2. Know the principles of chemical kinetics & to use them in assigningexpiry date for Formulation 3. Demonstrate use of physicochemical properties in evaluation of dosageforms. Appreciate physicochemical properties of drug molecules in formulationresearch and Development
6	Course Outcomes	CO403.1: Students would be able to understand the concept of reaction kinetics, degradation pathways, factor effects stability of drugs, acceleratedstability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention CO403.2: Students would be able to understand flow of liquid, law of flow, determination of viscosity of liquid by viscometer, types of flow mechanism, thixotropy in formulation and deformation of solids. CO403.3: Students would be able to apply the basics of surface and interfacial tension, surface active agents, HLB and adsorption in formulation and development of pharmaceutical systems. CO403.4: Students would be able to describe properties of powder like particle size and distribution, determining particle size by different methods, determining surface area, adsorption on particles and derivedproperties of powder CO403.5: Students would be able to learn about colloidal dispersion, roleof particle size and shape in colloidal dispersion, classification of dispersion system and various properties like optical, kinetic and electrical
7	Course Description	**UNIT-I** **Colloidal dispersions:** Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization& protective action.

		UNIT-II **Rheology:** Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers **Deformation of solids:** Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus **UNIT-III** **Coarse dispersion:** Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method. **UNIT IV** **Micromeretics:** Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties. **UNIT-V** **Drug stability:** Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention
8	Outline syllabus	
	1	**UNIT-I** **07 Hours** **Colloidal dispersions:** Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization& protective action.

	2	**UNIT-II** **10 Hours** **Rheology:** Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers **Deformation of solids:** Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus		
	3	**UNIT-III** **10 Hours** **Coarse dispersion:** Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.		
	4	**UNIT IV** **Micromeretics:** Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.		
	5	**UNIT-V** **10 Hours** **Drug stability:** Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. Physical Pharmacy by Alfred Martin, Sixth edition 2. Experimental pharmaceutics by Eugene, Parott. 3. Tutorial pharmacy by Cooper and Gunn. 4. Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.		

		5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3,Marcel Dekkar Inc. 6. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1,2, 3. Marcel Dekkar Inc. 7. Physical Pharmaceutics by Ramasamy C, and Manavalan R.

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: IV**
1	Course Code	BP404T
2	Course Title	Pharmacology I - Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of this course the student should be able to 1. Understand the pharmacological actions of different categories of drugs 2. Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels. 3. Apply the basic pharmacological knowledge in the prevention and treatment ofvarious diseases. 4. Observe the effect of drugs on animals by simulated experiments 5. Appreciate correlation of pharmacology with other bio medical sciences
6	Course Outcomes	**CO404.1**: Understand the pharmacological actions of different categoriesof drugs. **CO404.2:** Explain the mechanism of drug action at organ system/sub cellular/macromolecular levels. **CO404.3:** Apply the basic pharmacological knowledge in the preventionand treatment of various diseases. **CO404.4:** Observe the effect of drugs on animals by simulatedexperiments. **CO404.5:**Appreciate correlation of pharmacology with other bio medicalSciences.
7	Course Description	**UNIT-I** **1. General Pharmacology** a. Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes ofdrug administration, Agonists, antagonists(competitive and non competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy. b. Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination **UNIT-II** **General Pharmacology** a. Pharmacodynamics- Principles and mechanisms of drug action.Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions

		signal transduction mechanisms, G-protein–coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action. b. Adverse drug reactions. c. Drug interactions (pharmacokinetic and pharmacodynamic) Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, d. clinical trial phase, phases of clinical trials and pharmacovigilance. **UNIT-III** **Pharmacology of drugs acting on peripheral nervous system** Organization and function of ANS. Neurohumoral transmission,co-transmission and classification of neurotransmitters. Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral). Local anesthetic agents. Drugs used in myasthenia gravis and glaucoma **UNIT-IV** **Pharmacology of drugs acting on central nervous system** Neurohumoral transmission in the C.N.S.special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine. General anesthetics and pre-anesthetics**.** Sedatives, hypnotics and centrally acting muscle relaxants. Anti-epileptics Alcohols and disulfiram **UNIT-V** **Pharmacology of drugs acting on central nervous system** Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents,anti-manics and hallucinogens. Drugs used in Parkinsons disease and Alzheimer's disease. CNS stimulants and nootropics. Opioid analgesics and antagonists Drug addiction, drug abuse, tolerance and dependence.
8	Outline syllabus	

	1	**UNIT-I** **1. General Pharmacology** c. Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes ofdrug administration, receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy. d. Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination Agonists, antagonists(competitive and non competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis,
	2	**UNIT-II** **12 Hours** **General Pharmacology** Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action. a. Adverse drug reactions. b. Drug interactions (pharmacokinetic and pharmacodynamic) Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, c. clinical trial phase, phases of clinical trials and pharmacovigilance.
	3	**UNIT-III** **10 Hours** **Pharmacology of drugs acting on peripheral nervous system** Organization and function of ANS. Neurohumoral transmission,co-transmission and classification of neurotransmitters. Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral). Local anesthetic agents. Drugs used in myasthenia gravis and glaucoma
	4	**UNIT-IV** **08 Hours** **Pharmacology of drugs acting on central nervous system**

		a. Neurohumoral transmission in the C.N.S.special emphasis on importance of variousneurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine. **b.** General anesthetics and pre-anesthetics**.** c. Sedatives, hypnotics and centrally acting muscle relaxants. d. Anti-epileptics e. Alcohols and disulfiram		
	5	**UNIT-V** **07 Hours** **Pharmacology of drugs acting on central nervous system** a. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents,anti-manics and hallucinogens. b. Drugs used in Parkinsons disease and Alzheimer's disease. c. CNS stimulants and nootropics. d. Opioid analgesics and antagonists e. Drug addiction, drug abuse, tolerance and dependence.		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology,.Churchil Livingstone Elsevier 2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata McGraw-Hill 3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics 4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point LippincottWilliams & Wilkins 5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology		
	Other References			

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: IV**
1	Course Code	BP405T
2	Course Title	Pharmacognosy and Phytochemistry I - Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon the completion of the course student shall be able to 1. Understand the techniques in the cultivation and production ofcrude drugs. 2. Identify the crude drugs, their uses and chemical nature. 3. Understand the evaluation techniques for the herbal drugs. 4. Carry out the microscopic and morphological evaluation of crudedrugs
6	Course Outcomes	CO405.1: Students shall be able to define pharmacognosy, identify the sources of crude drugs, describe type of adulteration, evaluation of crude drugs, cultivation techniques, various medicine systems and plant tissue culture. CO405.2: Students will be able to classify the crude drugs, understandtheir properties, chemical nature and uses and are able to distinguish drugswith the help of chemical tests and describe various cultivation techniques. CO405.3: Students can apply their knowledge in identification, cultivation, evaluation of drugs, and prescribing the crude drug for varioushealth issues. CO405.4: Students will analyze the crude drugs and its chemical nature and their activities. CO405.5: Students would be able to compare two drugs with the help of chemical and physical properties, and evaluate them for their quality.
8	Outline syllabus	
	1	**UNIT-I** **10 Hours** **Introduction to Pharmacognosy:** (a) Definition, history, scope and development of Pharmacognosy (b) Sources of Drugs – Plants, Animals, Marine & Tissue culture (c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums andmucilages, oleoresins and oleo- gum -resins). **Classification of drugs:** Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs **Quality control of Drugs of Natural Origin:** Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leafconstants, camera lucida and diagrams of microscopic objects to scale with camera lucida.
	2	**UNIT-II** **10 Hours**

		Cultivation, Collection, Processing and storage of drugs of natural origin: Cultivation and Collection of drugs of natural origin Factors influencing cultivation of medicinal plants. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants **Conservation of medicinal plants**		
	3	**UNIT-III** **07 Hours** **Plant tissue culture:** Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy.Edible vaccines		
	4	**UNIT IV** **08 Hours** Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs **Plant Products:** Fibers - Cotton, Jute, Hemp Hallucinogens, Teratogens, Natural allergens		
	5	**UNIT V** **08 Hours** Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs **Plant Products:** Fibers - Cotton, Jute, Hemp Hallucinogens, Teratogens, Natural allergens **Primary metabolites:** General introduction, detailed study with respect to chemistry, General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites: **Carbohydrates:** Acacia, Agar, Tragacanth, Honey **Proteins and Enzymes :** Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin). **Lipids(Waxes, fats, fixed oils)** : Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax **Marine Drugs:** Novel medicinal agents from marine sources		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co.,London, 2009. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.		

		Text Book of Pharmacognosy by T.E. Wallis Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition,Nirali Prakashan, New Delhi. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, NewDelhi. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, NewDelhi, 2007 Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae Anatomy of Crude Drugs by M.A. Iyengar
	Other References	

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: 4**
1	Course Code	BP406 P
2	Course Title	**MEDICINAL CHEMISTRY-I (PRACTIAL)**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	Upon completion of the course, the student shall be able to -Know the classification and salient features of five kingdoms of life -Understand the basic components of anatomy & physiology of plant -Know understand the basic components of anatomy & physiologyanimal with special reference to human
6	Course Outcomes	C406.1P Students will discover practical laboratory skills and get hands-on experience of modern scientific instrumentation and methodology, particularly in relation to the chemistry of pharmaceuticals C406.2P Students will receive knowledge and understanding of thefundamental principles of chemistry and their applications to pharmaceuticals. C406.3P Students will be able to use and apply their skills and methodology to a range of techniques used in pharmaceutical chemistry. C406.4P Students will analyze professional transferable skills asexemplified by problem solving and teamwork. C406.5P Students will predict the skills to make synthetic scheme forcertain reactions involved in synthesis of drugs. C406.6P Students will integrate knowledge about different analytical methods to establish qualitative aswell as quantitative reports about thechemical entity.
7	Course Description	Preparation of drugs/ intermediates, assay of drugs and determination of Partition coefficient.
8	Outline syllabus	
	1	I Preparation of drugs/ intermediates 1,3-pyrazole 1,3-oxazole Benzimidazole
	2	Benztriazole 2,3- diphenyl quinoxaline Benzocaine Phenytoin Phenothiazine
	3	**Assay of drugs** Barbiturate II Assay of drugs

		Chlorpromazine Phenobarbitone Atropine Ibuprofen		
	4	**Determination of Partition coefficient for any two drugs**		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		05	10	35
	Text book/s*	1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry. 2. Foye's Principles of Medicinal Chemistry. 3. Burger's Medicinal Chemistry, Vol I to IV. 4. Introduction to principles of drug design- Smith and Williams. 5. Remington's Pharmaceutical Sciences. Martindale's extra pharmacopoeia		
	Other References			

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: 4**
1	Course Code	BP407 P
2	Course Title	**PHYSICAL PHARMACEUTICS II (PRACTICAL)**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	Upon completion of the course, the student shall be able to -Know the classification and salient features of five kingdoms of life -Understand the basic components of anatomy & physiology of plant -Know understand the basic components of anatomy & physiologyanimal with special reference to human
6	Course Outcomes	**CO407P.1:** Thestudents would be able to describe the derived properties of powder like angle of repose, bulk density, true density and porosity. **CO407P.2:** Thestudents would be able to demonstrate methods for determination of HLB value and Critical Micelle concentration of surfactants. **CO407P.3:** Thestudents would learn about the particle size, particle size distribution by using methods like Sieving and Microscopic. **CO407P.4:** The students would be able to describe the viscosity, effect of sedimentation on suspension **CO407P.5:** The students would be able to describe rate of reaction and accelerated stability studies according to ICH guidelines.
7	Course Description	Determination of particle size, particle size distribution, derived properties of powder, viscosity, effect of suspending agent on sedimentation volume, factors affecting viscosity, viscosity determination and various stability studies as per ICH guidelines
8	Outline syllabus	
	1	1. Determination of particle size, particle size distribution using sieving method. 2. Determination of particle size, particle size distribution using microscopic method. 3. Determination of bulk density, true density and porosity. 4. Determine angle of repose and influence of lubricant on angle of repose 5. Determination of viscosity of liquid using Ostwald's viscometer 6. Determination sedimentation volume with effect of different suspendingagent

<table>
<tr><td></td><td></td><td colspan="3">7. Determination of sedimentation volume with effect of different concentration of single suspending agent
8. Determination of viscosity of semisolid by using Brookfield viscometer
9. Determination of reaction rate constant first order.
10. Determination of reaction rate constant second order
Accelerated stability studies</td></tr>
<tr><td></td><td>2</td><td colspan="3">Determination of particle size, particle size distribution using sieving method& microscopic method
• Determination of particle size
• Determination of particle size distribution
• Using the sieving method</td></tr>
<tr><td></td><td>3</td><td colspan="3">To determine the derived properties of powder
• Determine the bulk density, true density andporosity of the powder
• Determine the flow properties of powder
• Determine the effect of glidants on flowproperties of powder</td></tr>
<tr><td></td><td>4</td><td colspan="3">Determination of viscosity of liquids & semi solids
• Determination of viscosity of liquid by usingOstwald’s viscometer
• Determination of viscosity of different concentration of glycerineby using Ostwald’sviscometer</td></tr>
<tr><td></td><td>5</td><td colspan="3">Determination of sedimentation volume of suspension
• Determination sedimentation volume with effect of different suspending agent
• Determination of sedimentation volume with</td></tr>
<tr><td></td><td>Mode of examination</td><td colspan="3">Theory/Jury/Practical/Viva</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">Weightage Distribution</td><td>Continuous Mode Assessment</td><td>Sessional Exam</td><td>ESE</td></tr>
<tr><td>05</td><td>10</td><td>35</td></tr>
<tr><td></td><td>Text book/s*</td><td colspan="3">1. Physical Pharmacy by Alfred Martin, Sixth edition
2. Experimental pharmaceutics by Eugene, Parott.
3. Tutorial pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3,Marcel Dekkar Inc.</td></tr>
<tr><td></td><td>Other References</td><td colspan="3"></td></tr>
</table>

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: 4**
1	Course Code	BP408 P
2	Course Title	**Pharmacology I Practical**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	**Objectives:** 1**.** Upon the completion of the course student shall be able to 2. Understand the pharmacological actions of different categories of drugs. 3.Observe the effect of drugs on animals by simulated experiments 4.Appreciate correlation of pharmacology with other bio medical sciences
6	Course Outcomes	**CO408P.1:** Thestudents would be able to explain the pharmacologicalaspects of drugs. **CO408P.2:** Thestudents would be able to handle and carry out the animal experiments **CO408P.3:** Thestudents would be able to appreciate the importance of pharmacology subject as a basis oftherapeutics. **CO408P.4:** The students would be able to Correlate and apply the knowledgetherapeutically.
7	Course Description	Introduction to experimental pharmacology. Commonly used instruments in experimental pharmacology. Study of common laboratory animals. Maintenance of laboratory animals as per CPCSEA guidelines. Common laboratory techniques. Blood withdrawal, serum and plasmaseparation, anesthetics and euthanasia used for animal studies. Study of different routes of drugs administration in mice/rats. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice. Effect of drugs on ciliary motility of frog oesophagus Effect of drugs on rabbit eye.

<table>
<tr><td></td><td></td><td>Effects of skeletal muscle relaxants using rota-rod apparatus.
Effect of drugs on locomotor activity using actophotometer.
Anticonvulsant effect of drugs by MES and PTZ method.
Study of stereotype and anti-catatonic activity</td></tr>
<tr><td>8</td><td>Outline syllabus</td><td></td></tr>
<tr><td></td><td>1</td><td>Basic Pharmacology Experiment
• Introduction to experimental pharmacology.
• Commonly used instruments in experimentalpharmacology.
• Study of common laboratory animals.
• Maintenance of laboratory animals as perCPCSEA guidelines.</td></tr>
<tr><td></td><td>2</td><td>To Study common lab techniques and study the effects of Drugs
• Common laboratory techniques. Blo withdrawal, serum and plasma separation, anesthetics and euthanasi
• Study of different routes of drugs administration in mice/rats.
• Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.
• Effect of drugs on ciliary motility of frog oesophagus
Effect of drugs on rabbit eye.
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<tr><td></td><td rowspan="2">Weightage Distribution</td><td>Continuous Mode Assessment</td><td>Sessional Exam</td><td>ESE</td></tr>
<tr><td></td><td>05</td><td>10</td><td>35</td></tr>
<tr><td></td><td>Text book/s*</td><td>1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale’s Pharmacology, Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata McGraw-Hill
3. Goodman and Gilman’s, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The</td></tr>
</table>

		Point LippincottWilliams & Wilkins 5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology
	Other References	

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: 4**
1	Course Code	BP409 P
2	Course Title	**Pharmacogonosy and Phytochemistry Practical**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	Upon completion of the course the student shall be able to understand different methods for analysis of crude drugs by various evaluation parameters i.e. Physical, chemical and organoleptic and anatomical parameters.
6	Course Outcomes	CO409.1P Students will discover practical laboratory skills and get hands-on experience of modern scientific instrumentation in relation to the pharmacognosy. CO409.2P Students will receive knowledge and understanding of thefundamental principles of pharmacognosy and their applications to pharmaceuticals. CO409.3P Students will be able to use and apply their skills to a range of techniques used in pharmacognosy. CO409.4P Students will analyze various crude drugs by various methods. CO409.5P Students would be able to evaluate various crude drugs for their quality.
7	Course Description	Analysis of crude drugs by chemical tests: **(**i)Tragaccanth (ii) Acacia(iii)Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil Determination of stomatal number and index Determination of vein islet number, vein islet termination and palisaderatio. Determination of size of starch grains, calcium oxalate crystals by eyepiece micrometer Determination of Fiber length and width Determination of number of starch grains by Lycopodium spore method Determination of Ash value Determination of Extractive values of crude drugsDetermination of moisture content of crude drugs Determination of swelling index and foaming index.
8	Outline syllabus	
	1	**I Experiments involving laboratory techniques** Chemical analysis

		Macroscopical and microscopical analysis Use of microscope, camera lucida, eye piecemicrometer etc.		
	2	**II Determination of physical evaluationparameters** Ash values Extractive values Moisture content Swelling and foaming index		
	3	**III Evaluation of crude drugs by anatomical/microscopical evaluation** Stomatal number and Stomatal Index Vein islet, vein termination and Palisade ratio Fiber length and width Size of starch grains and calcium oxalate crystals		
	4	**Chemical and Quantitative analysis** Analysis of crude drugs by chemical tests Quantitative analysis by lycopodium sporemethod		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		05	10	35
	Text book/s*	1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co.,London, 2009. 2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988. 3. Text Book of Pharmacognosy by T.E. Wallis 4. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi. 5. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition,Nirali Prakashan, New Delhi. 6. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, NewDelhi		
	Other References			

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: V**
1	Course Code	BP501T
2	Course Title	Medicinal Chemistry-II - Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the course the student shall be able to 1. understand the chemistry of drugs with respect to their pharmacological activity 2. understand the drug metabolic pathways, adverse effect and therapeuticvalue of drugs 3. know the Structural Activity Relationship (SAR) of different class of drugs write the chemical synthesis of some drugs
6	Course Outcomes	CO501.1 The students will have the knowledge to identify, name andclassify the different categories of drugs with respect to their pharmacological activities. CO501.2 The students will understand and explain the structure activity relationship, drug metabolic pathways, adverse effects and their therapeuticactivity of different categories of drugs. CO501.3 The students can apply the knowledge to construct the chemicalsynthesis of some drugs. CO501.4 The students will analyse chemical reactions, stabilities of compounds and properties of the compounds prepared by them in thelaboratory. CO501.5 The students can modify and design new chemical compounds with therapeutic activity.
8	Outline syllabus	
	1	Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*) **Unit I** **Antihistaminic agents:** Histamine, receptors and their distribution in the human body. **H_1–antagonists:**Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines cuccinate, Clemastine fumarate, Diphenylphyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn sodium

		H_2-antagonists: Cimetidine*, Famotidine, Ranitidin. **Gastric Proton pump inhibitors:** Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole **Anti-neoplastic agents:** **Alkylating agents:**Meclorethamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepa **Antimetabolites:** Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine **Antibiotics:**Dactinomycin, Daunorubicin,Doxorubicin, Bleomycin **Plant products:** Etoposide, Vinblastin sulphate, Vincristin sulphate **Miscellaneous:** Cisplatin, Mitotane.
	2	**Unit II** **Anti-anginal**: **Vasodilators:** Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole. **Calciumchannel blockers:** Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine. **Diuretics:** Carbonicanhydrase inhibitors: Acetazolamide*, Methazolamide,Dichlorphenamide. Thiazides:Chlorthiazide*,Hydrochlorothiazide, Hydroflumethiazide,Cyclothiazide, Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid. Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride.Osmotic Diuretics: Mannitol **Anti-hypertensive Agents**: Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.
	3	**Unit III** **Anti-arrhythmic Drugs**: Quinidine sulphate, Procainamide hydrochloride,

		Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcainide hydrochloride, Amiodarone, Sotalol. **Anti-hyperlipidemicagents**:Clofibrate, Lovastatin,CholesteramineandCholestipol **Coagulant&Anticoagulants**:Menadione,Acetomenadione,Warfarin*, Anisindione, clopidogrel **Drugs used in Congestive Heart Failure:** Digoxin, Digitoxin, Nesiritide,Bosentan, Tezosentan.
	4	**UNIT- IV** **08 Hours** **Drugs acting on Endocrine system** Nomenclature, Stereochemistry and metabolism of steroids **Sex hormones**: Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol. **Drugs for erectile dysfunction:** Sildenafil, Tadalafil. **Oral contraceptives:** Mifepristone, Norgestril, Levonorgestrol **Corticosteroids:**Cortisone, Hydrocortisone Prednisolone,Betamethasone, Dexamethasone **Thyroid and antithyroid drugs**: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole.
	5	**UNIT – V** **07 Hours** **Antidiabetic agents:** Insulin and its preparations Sulfonyl ureas Tolbutamide*, Chlorpropamide,Glipizide, Glimepiride. Biguanides: Metformin. ThiazolidinedionPioglitazone, Rosiglitazone.Meglitinides: Repaglinide, Nateglinide. Glucosidase inhibitors: Acrabose, Voglibose. **Local Anesthetics:** SAR of Local anesthetics **Benzoic Acid derivatives**; Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine, Piperocaine. **Amino Benzoic acid derivatives**: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate. **Lidocaine/Anilide derivatives**: Lignocaine, Mepivacaine, Prilocaine, Etidocaine.

		Miscellaneous: Phenacaine, Diperodon, Dibucaine.*		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry. 2. Foye's Principles of Medicinal Chemistry. 3. Burger's Medicinal Chemistry, Vol I to IV. 4. Introduction to principles of drug design- Smith and Williams. 5. Remington's Pharmaceutical Sciences. 6. Martindale's extra pharmacopoeia. 7. Organic Chemistry by I.L. Finar, Vol. II. 8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1to 5. 9. Indian Pharmacopoeia. 10. Text book of practical organic chemistry- A.I.Vogel.		
	Other References			

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: V**
1	Course Code	BP502 T
2	Course Title	Industrial Pharmacy I - Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the course the student shall be able to 1. Know about the various pharmaceutical dosage forms and their manufacturing techniques (large scale equipment's etc) 2. Understand the various considerations in development of pharmaceutical dosage forms 3. Develop solid, liquid dosage forms and evaluate them for their quality Know about containers, closures and packaging material used fordifferent type of dosage forms.
6	Course Outcomes	CO502 C.1: Students would be able to understand the concept of preformulation studies for the development of safe and effective dosageform. CO502.2: Students would be able to get the knowledge various types ofdosage form. (tablet, capsule, parenteral , liquid orals , pellets cosmeticpreparations etc) CO502.3: Students would be able to understand the formulation component and manufacturing procedures for different dosage form onLaboratory scale. CO502.4: Students would be able to analyze or evaluate the formulation fortheir quality. CO502.5: Students shall acquire knowledge of various packaging material for pharmaceutical products and evaluate them for quality.
8	Outline syllabus	
	1	**Unit I** Preformulation studies-I Introduction to Preformulation, Goals and Objective, study of physicochemical characteristics of drug substances. a. Physical properties: Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism b. Chemical Properties: Hydrolysis, oxidation, reduction, racemisation, polymerization BCS classification of drugs & its significant Application of preformulation considerations in the development of solid,

		liquidoral and parenteral dosage forms and its impact on stability of dosage forms.
	2	**Unit II** Tablets: a. Introduction, ideal characteristics of tablets, classification of tablets.Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipments and tablet tooling. b. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating. c. Quality control tests: In process and finished product tests Liquid orals: Formulation and manufacturing consideration of syrups and elixirssuspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia
	3	**Unit III** Capsules: a. Hard gelatin capsules: Introduction, Production of hard gelatin capsule shells. size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. In process and finalproduct quality control tests for capsules. b. Soft gelatin capsules: Nature of shell and capsule content, size of capsules,importance of base adsorption and minim/gram factors, production, inprocess and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules and their applications. Pellets: Introduction, formulation requirements, pelletization process, equipmentsfor manufacture of pellets
	4	**Unit IV** a. Definition, types, advantages and limitations. Preformulation factors andessential requirements, vehicles, additives, importance of isotonicity b. Production procedure, production facilities and controls, aseptic processing c. Formulation of injections, sterile powders, large volume parenterals and lyophilized products. d. Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products. Ophthalmic Preparations: Introduction, formulation considerations; formulation ofeye drops, eye ointments and eye lotions; methods of preparation; labeling, containers; evaluation of ophthalmic preparations
	5	**Unit V** Cosmetics: Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens Pharmaceutical Aerosols: Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies. Packaging Materials Science: Materials used for packaging of pharmaceutical products, factors influencing choice of containers, legal and official requirements for containers, stability aspects of packaging materials, quality control tests
	Mode of	Theory/Jury/Practical/Viva

	examination			
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman&J. B.Schwartz Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman &Lachman Pharmaceutical dosage form disperse system VOL-1 by Liberman & Lachman Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edition Remington: The Science and Practice of Pharmacy, 20th edition PharmaceuticalScience (RPS) Theory and Practice of Industrial Pharmacy by Liberman & Lachman Pharmaceutics- The science of dosage form design by M.E.Aulton, Churchilllivingstone, Latest edition Introduction to Pharmaceutical Dosage Forms by H. C.Ansel, Lea & Febiger,Philadelphia, 5thedition, 2005 Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition,Marcel Dekker Series, Vol 107.		

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: V**
1	Course Code	BP503 T
2	Course Title	Pharmacology II-Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of this course the student should be able to 1. Understand the mechanism of drug action and its relevance in the treatment of different diseases 2. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments 3. Demonstrate the various receptor actions using isolated tissue preparation 4. Appreciate correlation of pharmacology with related medical sciences
6	Course Outcomes	CO503.1: Students would be able to define and describe various categories of drugs to be used in the treatment of cardiovascular, haematological, endocrine and inflammatory disorders. CO503.2: Students would be able to understand and explain the mechanisms, pharmacokinetic profile, adverse effects and uses of various drugs. CO503.3: Students would be able to demonstrate the use of various categories of drugs and their bioassays. CO503.4: Students would be able to analyze and explain the pathology of the cardiovascular, blood related and endocrine disorders. CO503.5: Students would be able to evaluate and discriminate amongst the normal and abnormal physiological processes, and various drugs that can e employed for different treatment protocols.
8	Outline syllabus	
	1	Unit-1 **1. Pharmacology of drugs acting on cardio vascular system** a. Introduction to hemodynamic and electrophysiology of heart. b. Drugs used in congestive heart failure c. Anti-hypertensive drugs. d. Anti-anginal drugs. e. Anti-arrhythmic drugs. f. Anti-hyperlipidemic drugs.
	2	Unit-2 **1. Pharmacology of drugs acting on cardio vascular system**

<table>
<tr><td></td><td></td><td colspan="3">a. Drug used in the therapy of shock.
b. Hematinics, coagulants and anticoagulants.
c. Fibrinolytics and anti-platelet drugs
d. Plasma volume expanders
2. Pharmacology of drugs acting on urinary system
a. Diuretics
b. Anti-diuretics.</td></tr>
<tr><td></td><td>3</td><td colspan="3">Unit-3
3. Autocoids and related drugs
a. Introduction to autacoids and classification
b. Histamine, 5-HT and their antagonists.
c. Prostaglandins, Thromboxanes and Leukotrienes.
d. Angiotensin, Bradykinin and Substance P.
e. Non-steroidal anti-inflammatory agents
f. Anti-gout drugs
g. Antirheumatic drugs.</td></tr>
<tr><td></td><td>4</td><td colspan="3">Unit-4
4. Pharmacology of drugs acting on endocrine system
a. Basic concepts in endocrine pharmacology.
b. Anterior Pituitary hormones- analogues and their inhibitors.
c. Thyroid hormones- analogues and their inhibitors.
d. Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D.
d. Insulin, Oral Hypoglycemic agents and glucagon.
e. ACTH and corticosteroids.</td></tr>
<tr><td></td><td>5</td><td colspan="3">Unit-5
5. Pharmacology of drugs acting on endocrine system
a. Androgens and Anabolic steroids.
b. Estrogens, progesterone and oral contraceptives.
c. Drugs acting on the uterus.
6. Bioassay
a. Principles and applications of bioassay.
b.Types of bioassay
c. Bioassay of insulin, oxytocin, vasopressin, ACTH,d-tubocurarine,digitalis, histamine
and 5-HT</td></tr>
<tr><td></td><td>Mode of examination</td><td colspan="3">Theory/Jury/Practical/Viva</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">Weightage Distribution</td><td>Continuous Mode Assessment</td><td>Sessional Exam</td><td>ESE</td></tr>
<tr><td>10 Marks</td><td>15</td><td>75</td></tr>
<tr><td></td><td>Text book/s*</td><td colspan="3">1. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical</td></tr>
</table>

		publisher 2. Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert. 3. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company,Kolkata. 4. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: V**
1	Course Code	BP504T
2	Course Title	**Pharmacognosy – II Theory**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the course, the student shall be able 1. to know the modern extraction techniques, characterization andidentification of the herbal drugs and phytoconstituents 2. to understand the preparation and development of herbal formulation. 3. to understand the herbal drug interactions to carryout isolation and identification of phytoconstituents
6	Course Outcomes	CO504.1:Students would be able to define and describe various metabolic pathways, varioussecondary metabolites like alkaloids glycosides by spectroscopic techniques and chromatography and various extraction methods CO504.2:Students would be able to explain applications of phytoconstituents and theirindustrial production, isolation process and extraction methods CO504.3:Students would be able apply and demonstrate various identification process and latest technique of phytoconstituents CO504.4: Students would be able to separate and analyse various phytoconstituents CO504.5:Students would be able to estimate and evaluate various phytoconstituents
8	Outline Syllabus	
	1	**UNIT-I** **7 Hours** **Metabolic pathways in higher plants and their determination** a) Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway. b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.
	2	**UNIT-II** **14 Hours** General introduction, composition, chemistry & chemical classes, biosources, therapeuticuses and commercial applications of following secondary metabolites: **Alkaloids:** Vinca, Rauwolfia, Belladonna, Opium,

<table>
<tr><td></td><td></td><td colspan="3">Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta
Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis
Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander,
Tannins: Catechu, Pterocarpus
Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony
Glycosides: Senna, Aloes, Bitter Almond
Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, taxus, carotenoids</td></tr>
<tr><td></td><td>3</td><td colspan="3">UNIT-III 06 Hours
Isolation, Identification and Analysis of Phytoconstituents
a) Terpenoids: Menthol, Citral, Artemisin
b) Glycosides: Glycyrhetinic acid & Rutin
c) Alkaloids: Atropine,Quinine,Reserpine,Caffeine
d) Resins: Podophyllotoxin, Curcumin</td></tr>
<tr><td></td><td>4</td><td colspan="3">UNIT-IV 10 Hours
Industrial production, estimation and utilization of the following phytoconstituents: Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine,Taxol, Vincristine and Vinblastine</td></tr>
<tr><td></td><td>5</td><td colspan="3">UNIT V 8 Hours
Basics of Phytochemistry
Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crudedrugs.</td></tr>
<tr><td></td><td>Mode of examination</td><td colspan="3">Theory/Jury/Practical/Viva</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">Weightage Distribution</td><td>Continuous Mode Assessment</td><td>Sessional Exam</td><td>ESE</td></tr>
<tr><td>10 Marks</td><td>15</td><td>75</td></tr>
<tr><td></td><td>Text book/s*</td><td colspan="3">W.C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers &Distribution, New Delhi.
Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, NewDelhi.
Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007</td></tr>
</table>

		Herbal Cosmetics by H.Pande, Asia Pacific Business press, Inc, New Delhi. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi,2005. R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin, 1994. Pharmacognosy & Pharmacobiotechnology. James Bobbers, Marilyn KS, VE Tylor. The formulation and preparation of cosmetic, fragrances and flavours. 1. Remington's Pharmaceutical sciences. 2. Text Book of Biotechnology by Vyas and Dixit. 3. Text Book of Biotechnology by R.C. Dubey.
	Other References	

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: V**
1	Course Code	BP505T
2	Course Title	Pharmaceutical Jurisprudence - Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the course, the student shall be able tounderstand: 1. The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals. 2. Various Indian pharmaceutical Acts and Laws 3. The regulatory authorities and agencies governing the manufacture and sale of PharmaceuticalsCode of ethics
6	Course Outcomes	CO**505**.1: Students would be able to identify and understand theknowledgeof Legal definitions of schedules to the Act and Rules, license for manufacturingand sale of drugs. CO**505**.2: Students would be able to explain various schedules labelling andpackaging of drugs and various acts and rules. CO**505**.3: Students would be able to differentiate various acts and rulesSchedules sale of drugs and various Acts and Rules and apply Rules. CO**505**.4: Students would be able to infer various Acts and Rules and howto apply various acts and Rules. CO**505**.5: Students would be able to summarize the acts and code andconduct and also would explain Intellectual Proprietary Rights
8	Outline syllabus	
	1	**UNIT-I** **10 Hours** **Drugs and Cosmetics Act, 1940 and its rules 1945:** Objectives, Definitions, Legal definitions of schedules to the Act andRules Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties**.** Manufacture of drugs – Prohibition of manufacture and sale of certain

	2	**UNIT-II** **10 Hours** **Drugs and Cosmetics Act, 1940 and its rules 1945.** Detailed study of Schedule G, H, M, N, P,T,U, V, X, Y, Part XII B, Sch F & DMR (OA) Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties. Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, Licensing authorities, controlling authorities, Drugs Inspectors
	3	**UNIT-III** **10 Hours** **Pharmacy Act –1948**: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and Penalties • **Medicinal and Toilet Preparation Act –1955**: Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties. • **Narcotic Drugs and Psychotropic substances Act-1985 and Rules**: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties
	4	**UNIT-IV** **08 Hours** • **Study of Salient Features of Drugs and Magic Remedies Act and its rules:** Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties • **Prevention of Cruelty to animals Act-1960:** Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties • **National Pharmaceutical Pricing Authority:** Drugs Price Control Order (DPCO)- 2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations,Retail price and ceiling price of scheduled formulations, National List of EssentialMedicines (NLEM)
	5	**UNIT-V** **07 Hours** • **Pharmaceutical Legislations –** A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee • **Code of Pharmaceutical ethics** D efinition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath

		• **Medical Termination of Pregnancy Act** • **Right to Information Act** • **Introduction to Intellectual Property Rights (IPR)**		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	Continuous Mode Assessment	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. Text book of Forensic Pharmacy by B.M. Mithal 2. Hand book of drug law-by M.L. Mehra 3. A text book of Forensic Pharmacy by N.K. Jain 4. Drugs and Cosmetics Act/Rules by Govt. of India publications. 5. Medicinal and Toilet preparations act 1955 by Govt. of India publications. 6. Narcotic drugs and psychotropic substances act by Govt. of India publications 7. Drugs and Magic Remedies act by Govt. of India publication 8. Bare Acts of the said laws published by Government. Reference books (Theory)		

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: V**
1	Course Code	BP506P
2	Course Title	Industrial Pharmacy- I Practical
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	Upon completion of the course the student shall be able to 1. Know about the various pharmaceutical dosage forms and their manufacturing techniques(large scale equipment's etc) 2. Understand the various considerations in development of pharmaceutical dosage forms 3. Develop solid, liquid dosage forms and evaluate them for their quality Know about containers, closures and packaging material used fordifferent type of dosage forms.
6	Course Outcomes	CO506.1: Students would be able to get the knowledge various types ofdosage form. (tablet, capsule , Parenterals , creams etc) CO506.2: Students would be able to understand the manufacturing procedures for different dosage form on laboratory scale.(tablet, capsule,Parenterals , creams etc) CO506.3: Students would be able to understand or evaluate the Aerosols. CO506.4: Students shall acquire knowledge of various packaging material for pharmaceutical products and evaluate them for quality CO506.5: Students shall be able to understand the formulation of Cosmetics.
7	Course Description	To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences Formulation and evaluation of the following dosage forms containing drugs mentioned in pharmacopoeia. 1. Capsules. 2. Microcapsules/microspheres 3. Tablets by dry and wet granulation methods 4. Film coated tablets/ Enteric coated tablets, Ear drops

8	Outline Syllabus			
	1	To study the various instruments used in evaluation of tablet.		
	2	Evaluation of tablet as per IP.		
	3	Prepare and evaluate granules of Calcium lactate 50 Tablets.		
	4	To compress the prepared granules Of Acetyl salicylic acid by using Tablet Making Machine and determine their Disintegration Time and hardness of prepared tablets.		
	5	To study the effect of coating on disintegration oftablets.		
	6	To prepare effervescent granules by hot and wet method.		
	7	To prepare microcapsules by using phase separation& coacervation technique brought about by polymerpolymer interaction.		
	8	To prepare and submit cold cream		
	9	Preparation of injection		
	10	To prepare and submit vanishing cream		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman& J.B.Schwartz. Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman &Lachman Pharmaceutical dosage form disperse system VOL-1 by Liberman & Lachman		
	Other References			

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: V**
1	Course Code	BP507P
2	Course Title	Pharmacology- II Practical
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	Upon completion of this course the student should be able to 1. Understand the mechanism of drug action and its relevance in the treatment ofdifferent diseases 2. Demonstrate isolation of different organs/tissues from the laboratory animals bysimulated experiments 3. Demonstrate the various receptor actions using isolated tissue preparation 4. Appreciate correlation of pharmacology with related medical sciences
6	Course Outcomes	CO507.1: Students would be able to define and describe various instrumentsand methods used in the evaluation of *in vitro* and *in vivo* evaluation of various drugs. CO507.2: Students would be able to understand and explain the working principles of the instruments used and actions of various drugs on biological systems. CO507.3: Students would be able to demonstrate the effects of variouscategories of drugs and bioassays of physiological substances. CO507.4: Students would be able to analyze and explain the outcomes of experiments through simulation studies. CO507.5: Students would be able to evaluate and discriminate amongst the normal and abnormal physiological processes, and various drugs that can beemployed for different treatment protocols.
8	Outline Syallabus	
	1	Introduction to *in-vitro* pharmacology andphysiological salt solutions.
	2	Effect of drugs on isolated frog heart.
	3	Effect of drugs on blood pressure and heart rate ofdog.
	4	Study of diuretic activity of drugs using rats/mice.
	5	DRC of acetylcholine using frog rectus abdominismuscle.
	6	Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle andrat ileum respectively.
	7	Bioassay of histamine using guinea pig ileum bymatching method.

	8	Bioassay of oxytocin using rat uterine horn byinterpolation method.		
	9	Bioassay of serotonin using rat fundus strip bythree point bioassay.		
	10	Bioassay of acetylcholine using rat ileum/colon byfour point bioassay.		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company,Kolkata. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.		
	Other References			

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: V**
1	Course Code	BP508P
2	Course Title	**Pharmacognosy - II Practical**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	1. Explain correct use of various equipments in Pharmacognosy laboratory. 2. Handle simple/compound microscope in technically correct way. 3. Expain and understand the Morphology, histology and powdercharacteristics 4. Demonstrate skill of plant material sectioning, staining, mounting &focusing. 5. Decide on staining reagents required for specific part of plant. 6. Demonstrate Isolation and detection methods 7. Separate phytoconstituents by TLC
6	Course Outcomes	CO508.1:Students would able to identify and describe the morphology and chemical test of crude drugs CO508.2:Students would be able to explain and compare the microscopy of crude drugs and powder CO508.3:Students would be able to calculate the Rf value of phytoconstitunts CO508.4: Students would be able to separate and analyse the phytoconstituents CO508.5: Students would be able to isolate the compounds.
7	Course Description	Morphology, histology and powder characteristics & extraction & detection of:Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander Exercise involving isolation & detection of active principles a. Caffeine - from tea dust. b. Diosgenin from Dioscorea c. Atropine from Belladonna d. Sennosides from Senna 2. Separation of sugars by Paper chromatography 3. TLC of herbal extract

		4. Distillation of volatile oils and detection of phytoconstitutents by TLC 5. Analysis of crude drugs by chemical tests: **(**i) Asafoetida (ii) Benzoin (iii)Colophony (iv) Aloes (v) Myrrh		
8	Outline Syllabus			
	1	To study the morphological and microscopy ofCinchona bark.		
	2	To study the morphological and microscopy of Fennelfruits.		
	3	To study the morphological characteristics of Sennaleaves, Cinnamon bark and Ephedra stem		
	4	To study the powder characteristics of clove buds andCinnamon bark		
	5	To study the morphological, and histologicalcharacteristics of clove bud		
	6	To study the morphological, microscopy and powdercharacteristics of Ephedra stem		
	7	To extract Caffeine from tea powder and identify by Thin Layer chromatography		
	8	To perform separation of sugars by Paperchromatography		
	9	To perform Thin Layer chromatography of the givenherbal extract.		
	10	To isolate volatile oil by hydrodistillation method using Clavengers apparatusDetermination of viscosity of liquid using Ostwald's viscometer		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi,2005. 2. R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin, 1994. 3. Pharmacognosy & Pharmacobiotechnology. James Bobbers, Marilyn KS, VE Tylor. 4. The formulation and preparation of cosmetic, fragrances and flavours. 5. Remington's Pharmaceutical sciences. 6. Text Book of Biotechnology by Vyas and Dixit. 7. Text Book of Biotechnology by R.C. Dubey.		
	Other References			

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: VI**
1	Course Code	BP601T
2	Course Title	Medicinal Chemistry III – Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the course student shall be able to- 1. Understand the importance of drug design and different techniques of drug design. 2. Understand the chemistry of drugs with respect to their biologicalactivity. 3. Know the metabolism, adverse effects and therapeutic value of drugs. Know the importance of SAR of drugs.
6	Course Outcomes	**CO601.1**: Student will get fundamental knowledge of the structure,chemistry and its correlation with the therapeutic value of drugs. **CO601.2:** Students will have conceptual knowledge and background ofdrugs and ensure their rational use. **CO601.3:** Students will possess the basic knowledge about the synthesisand Structure Activity Relationships (SAR) associated with the drugs structure. **CO601.4:** Student will also understand the chemistry, mechanism of action, metabolism, adverse effects, and therapeutic uses of importantdrugs. **CO601.5:** Students will be able to understand the modern techniques ofrational drug design like quantitative structure activity relationship
8	Outline syllabus	
	1	**UNIT – I** **10 Hours** **Antibiotics** Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. **β-Lactam antibiotics:** Penicillin, Cepholosporins, β- Lactamase inhibitors, Monobactams **Aminoglycosides:** Streptomycin, Neomycin, Kanamycin **Tetracyclines:** Tetracycline,Oxytetracycline, Chlortetracycline
	2	**UNIT – II** **10 Hours**

		Antibiotics Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. **Macrolide:** Erythromycin Clarithromycin, Azithromycin. **Miscellaneous:** Chloramphenicol*, Clindamycin. **Prodrugs:** Basic concepts and application of prodrugs design. **Antimalarials:** Etiology of malaria. **Quinolines:** SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine. **Biguanides and dihydro triazines:** Cycloguanil pamoate, Proguanil. **Miscellaneous:** Pyrimethamine, Artesunete, Artemether, Atovoquone
	3	**UNIT – III** **10 Hours** **Anti-tubercular Agents** **Synthetic anti tubercular agents:** Isoniozid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.* **Anti tubercular antibiotics:** Rifampicin, Rifabutin, Cycloserine Streptomycine, Capreomycin sulphate. **Urinary tract anti-infective agents** **Quinolones:** SAR of quinolones, Nalidixic Acid,Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin,Gatifloxacin,Moxifloxacin **Miscellaneous:** Furazolidine, Nitrofurantoin*, Methanamine. **Antiviral agents:** Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirding, Ribavirin, Saquinavir, Indinavir,
	4	**UNIT – IV** **08 Hours** **Antifungal agents:** **Antifungal antibiotics:** Amphotericin-B, Nystatin, Natamycin, Griseofulvin. **Synthetic Antifungal agents:** Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconozole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*. **Anti-protozoal Agents:** Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine. **Anthelmintics:** Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin. **Sulphonamides and Sulfones** Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxaole*, Sulphadiazine, Mefenide acetate, Sulfasalazine. **Folate reductase inhibitors:** Trimethoprim*, Cotrimoxazole. **Sulfones:** Dapsone*.

	5	**UNIT – V** **07 Hours** **Introduction to Drug Design** Various approaches used in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Tafts steric parameter and Hansch analysis. Pharmacophore modeling and docking techniques. **Combinatorial Chemistry:** Concept and applicationschemistry: solid phase and solution phase synthesis.		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. Wilson and Giswold's Organic medicinal and PharmaceuticalChemistry. 2. Foye's Principles of Medicinal Chemistry. 3. Burger's Medicinal Chemistry, Vol I to IV. Introduction to principles of drug design- Smith and Williams		
	Other References	Text book of practical organic chemistry- A.I.Vogel.		

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: VI**
1	Course Code	BP602T
2	Course Title	**Pharmacology - III – Theory**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of this course the student should be able to: 1. understand the mechanism of drug action and its relevancein the treatment of different infectious diseases 2. comprehend the principles of toxicology and treatment of various poisonings 3. appreciate correlation of pharmacology with related medicalsciences.
6	Course Outcomes	CO602.1: Students would be able to define and describe various categories of drugs to be used in the treatment of respiratory, gastrointestinal, infectious andmalignant disorders. CO602.2: Students would be able to understand and explain the mechanisms, pharmacokinetic profile, adverse effects and uses of various drugs. CO602.3: Students would be able to demonstrate the use of various categories ofdrugs and their bioassays. CO602.4: Students would be able to analyze and explain the pathology of cancer, infectious, respiratory and gastrointestinal diseases. CO602.5: Students would be able to evaluate and discriminate amongst the normal and abnormal physiological processes, and various drugs that can beemployed for different treatment protocols.
8	Outline syllabus	
	1	**UNIT-I** **Pharmacology of drugs acting on Respiratory system** a. Anti -asthmatic drugs b. Drugs used in the management of COPD c. Expectorants and antitussives d. Nasal decongestants 2. Respiratory stimulants **Pharmacology of drugs acting on the Gastrointestinal Tract** a. Antiulcer agents. b. Drugs for constipation and diarrhoea.

		c. Appetite stimulants and suppressants. d. Digestants and carminatives. e. Emetics and anti-emetics.
	2	**UNIT-II** **Chemotherapy** a. General principles of chemotherapy. b. Sulfonamides and cotrimoxazole. c.Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline andaminoglycosides
	3	**UNIT-III** **Chemotherapy** a. Antitubercular agents b. Antileprotic agents c. Antifungal agents d. Antiviral agents e. Anthelmintic agents f. f. Antimalarial drugs a. g. Antiamoebic agents
	4	**UNIT-IV** **Chemotherapy** l. Urinary tract infections and sexually transmitted diseases. m. Chemotherapy of malignancy. **Immunopharmacology** a. Immunostimulants b. Immunosuppressant Protein drugs, monoclonal antibodies, target drugs to antigen,biosimilars
	5	**UNIT-V** **Principles of toxicology** a. Definition and basic knowledge of acute, subacute and chronictoxicity. Definition and basic knowledge of genotoxicity,carcinogenicity, teratogenicity and mutagenicity General principles of treatment of poisoning b. Clinical symptoms and management of barbiturates, morphine, organophosphosphorus compound and lead, mercury and arsenic poisoning. **Chronopharmacology** c. Definition of rhythm and cycles. Biological clock and their significance leading to chronotherapy.

	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology,Churchil Livingstone Elsevier 2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata McGraw-Hill 3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics 4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs. The Point LippincottWilliams & Wilkins 5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology 6. K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers MedicalPublishers (P) Ltd, New Delhi. 7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisherModern Pharmacology with clinical Applications, by Charles R.Craig& Robert, 8. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company,Kolkata, 9. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan, 10. N.Udupa and P.D. Gupta, Concepts in Chronopharmacology.		
	Other References			

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: VI**
1	Course Code	BP603T
2	Course Title	**Herbal Drug Technology – Theory**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the course, the student shall be able to 1. understand raw material as source of herbal drugs from cultivation to herbal drug product. 2. know the WHO and ICH guidelines for evaluation of herbal drugs. know the herbal cosmetics, natural sweeteners, neutraceuticals.
6	Course Outcomes	CO603.1: Students would be able to define herbal medicine, identify and authentication ofherbal materials,describe neutraceuticals and herbal drug interactions CO603.2: Students would be able to differentiate Indian system of medicine and would beable to describe Stability testing of herbal drugs and explain patenting CO603.3: Students would be able apply and various identification process and latesttechnique of phytoconstituents CO603.4: Students would be able to demonstrate evaluation of drugs according to W.H.O.guidelines..Patenting and regulatory requirements of natural and analyse various phytoconstituents CO603.5: Students would be able to evaluate various phytoconstituents Herbal drug IndustrySchedule T-Good manufacturing practices of Indian system of medicine
8	Outline syllabus	
	1	**UNIT-I** **11 Hours** **Herbs as raw materials** Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparationSource of Herbs Selection, identification and authentication of herbal materialsProcessing of herbal raw material **Biodynamic Agriculture** Good agricultural practices in cultivation of medicinal plants including Organic farming. Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides. **Indian Systems of Medicine** a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy

		a) Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas,Ghutika,Churna, Lehya and Bhasma.
	2	**UNIT-II** **7 Hours** **Nutraceuticals** General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases. Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina **Herbal-Drug and Herb-Food Interactions:** General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.
	3	**Unit III** **Herbal Cosmetics** Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products. **Herbal excipients:** Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes. **Herbal formulations :** Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage formslike phytosomes
	4	**UNIT- IV** **10 Hours** **Evaluation of Drugs** WHO & ICH guidelines for the assessment of herbal drugsStability testing of herbal drugs. **Patenting and Regulatory requirements of natural products:** a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting andBiopiracy b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma& Neem. **Regulatory Issues** - Regulations in India (ASU DTAB, ASU DCC), Regulation ofmanufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs.

	5	**UNIT-V** **07 Hours** **General Introduction to Herbal Industry** Herbal drugs industry: Present scope and future prospects. A brief account of plant based industries and institutions involved in work on medicinal andaromatic plants in India. **Schedule T – Good Manufacturing Practice of Indian systems of medicine** Components of GMP (Schedule – T) and its objectives Infrastructural requirements, working space, storage area, machinery and equipments,standard operating procedures, health and hygiene, documentation and records.		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. Textbook of Pharmacognosy by Trease & Evans. 2. Textbook of Pharmacognosy by Tyler, Brady & Robber. 3. Pharmacognosy by Kokate, Purohit and Gokhale 4. Essential of Pharmacognosy by Dr.S.H.Ansari 5. Pharmacognosy & Phytochemistry by V.D.Rangari 6. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research inIndian Medicine & Homeopathy) 7. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation ofBotanicals. Business Horizons Publishers, New Delhi, India, 2002.		
	Other References			

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: VI**
1	Course Code	BP604T
2	Course Title	Biopharmaceutics & Pharmacokinetics – Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the course student shall be able to: 1. Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance. 2. Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination. 3. To understand the concepts of bioavailability and bioequivalence of drug products and their significance. Understand various pharmacokinetic parameters, their significance & applications.
6	Course Outcomes	CO604.1: Students will learn to define and differentiate the meaning of Biopharmaceutics and Pharmacokinetics. In addition, they will be able toidentify the basic concepts and the parameters involved in biopharmaceutical expressions and their significance. CO 604.2: Students can associate basic concepts and importance of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination. CO604.3: Students will be able to categorize, sketch and relate various compartment models and their orientation while learning the parameters involved in the biopharmaceutical expression and infer the findings from such studies. CO604.4: Students will be able to correlate a study and interpret basic concepts, measurement and calculation of zero order and first order absorption rate constant involved in various biopharmaceutical and pharmacokinetics measurements. CO604.5: Students will be able to compile and integrate various constraints in developing data-base for individuals in diseased conditions and compare with the functioning of normal person while incorporating the concept of pharmacokinetic study.

8	Outline syllabus	
	1	**Unit I** **Introduction to Biopharmaceutics** **Absorption**; Mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT, absorption of drug from Non per oral extra-vascular routes, **Distribution** Tissue permeability of drugs, binding of drugs, apparent, volumeof drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs
	2	**UNIT- II** **10 Hours** **Elimination:** Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs **Bioavailability and Bioequivalence:** Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, *in-vitro* drug dissolution models, *in-vitro-in-vivo* correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.
	3	**UNIT- III** **10 Hours** **Pharmacokinetics:** Definition and introduction to Pharmacokinetics, Compartmentmodels, Non compartment models, physiological models, One compartment openmodel. (a). Intravenous Injection (Bolus) (b). Intravenous infusion and (c) Extra vascular administrations. Pharmacokinetics parameters - K_E ,t1/2,Vd,AUC,Ka, Clt and CL_R- definitions methods of eliminations, understanding of their significance and application
	4	**UNIT- I** ***Multicompartment models:*** Two compartment open model. IV bolus Kinetics of multiple dosing, steady state drug levels, calculation of loading and mainetnance doses and their significance in clinical settins.
	5	**UNIT-** **V** **07 Hours** **Nonlinear Pharmacokinetics:** a. Introduction, b. Factors causing Non-linearity. a. Michaelis-menton method of estimating parameters, Explanation with example of drugs.

	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi. 2. Biopharmaceutics and Pharmacokinetics; By Robert F Notari 3. Applied biopharmaceutics and pharmacokinetics, Leon Shargel and AndrewB.C.YU 4th edition,Prentice-Hall Inernational edition.USA 4. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar andSunil B.Jaiswal,Vallabh Prakashan Pitampura, Delhi 5. Pharmacokinetics: By Milo Glbaldi Donald, R. Mercel Dekker Inc. 6. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott byADIS Health Science Press. 7. Biopharmaceutics; By Swarbrick 8. Clinical Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and 9. Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995. 10. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack,Publishing Company,Pennsylvania 1989. 11. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th editionRevised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel, 1987. 12. Remington's Pharmaceutical Sciences, By Mack Publishing Company,Pennsylvnia		
	Other References			

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: VI**
1	Course Code	BP605T
2	Course Title	Pharmaceutical Biotechnology – Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the subject student shall be able to; 1. Understanding the importance of Immobilized enzymes in PharmaceuticalIndustries 2. Genetic engineering applications in relation to production of pharmaceuticals 3. Importance of Monoclonal antibodies in Industries 4.Appreciate the use of microorganisms in fermentation technology
6	Course Outcomes	CO605.1: Students will be able to understand the importance of Immobilized enzymes in Pharmaceutical Industries. CO605.2: Students will be able to study genetic engineering applications in relation to production of Pharmaceuticals CO605.3: Students will be able to study importance of Monoclonal antibodies in Industries CO605.4: Students will be able to understand the use of microorganisms in fermentation technology CO605.5: Students will be able to study various fermentation methods
8	Outline syllabus	
	1	**Unit I** **10 Hours** a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences. b) Enzyme Biotechnology- Methods of enzyme immobilization and applications. c) Biosensors- Working and applications of biosensors in

		Pharmaceutical Industries. d) Brief introduction to Protein Engineering. e) Use of microbes in industry. Production of Enzymes- General consideration -Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase. f) Basic principles of genetic engineering.
	2	**Unit II** **10 Hours** Types of immunity- humoral immunity, cellular immunity a) Structure of Immunoglobulins b) Structure and Function of MHC c) Hypersensitivity reactions, Immune stimulation and Immune suppressions. d) General method of the preparation of bacterial vaccines, toxoids, viral vaccine,antitoxins, serum-immune blood derivatives and other products relative to immunity. e) Storage conditions and stability of official vaccines f) Hybridoma technology- Production, Purification and Applications g) Blood products and Plasma Substituties.
	3	**Unit III** **10 Hours** Types of immunity- humoral immunity, cellular immunity a) Structure of Immunoglobulins b) Structure and Function of MHC c) Hypersensitivity reactions, Immune stimulation and Immune suppressions. d) General method of the preparation of bacterial vaccines, toxoids, viral vaccine,antitoxins, serum-immune blood derivatives and other products relative to immunity. e) Storage conditions and stability of official vaccines f) Hybridoma technology- Production, Purification and Applications g) Blood products and Plasma Substituties.

	4	**Unit** **IV** **08Hours** a) Immuno blotting techniques- ELISA, Western blotting, Southern blotting. b) Genetic organization of Eukaryotes and Prokaryotes c) Microbial genetics including transformation, transduction, conjugation, plasmids andtransposons. d) Introduction to Microbial biotransformation and applications. e) Mutation: Types of mutation/mutants.		
	5	**Unit** **V** **07 Hours** a) Fermentation methods and general requirements, study of media, equipments,sterilization methods, aeration process, stirring. b) Large scale production fermenter design and its various controls. c) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid,Griseofulvin, d) Blood Products: Collection, Processing and Storage of whole human blood, driedhuman plasma, plasma Substituties.		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press Washington D.C. 2. RA Goldshy et. al., : Kuby Immunology. 3. J.W. Goding: Monoclonal Antibodies. Zaborsky: Immobilized Enzymes, CRC Press, Degraland, Ohio. 4. S.B. Primrose: Molecular Biotechnology (Second Edition) Blackwell ScientificPublication. 5. Stanbury F., P., Whitakar A., and Hall J., S., Principles of fermentation technology,2nd edition, Aditya books Ltd., New Delhi		

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: VI**
1	Course Code	BP606T
2	Course Title	Pharmaceutical Quality Assurance – Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion, students will be familiar with various aspects of quality controland quality assurance aspects of pharmaceutical industries. It deals with theimportant aspects like cGMP, QC tests, documentation, quality certifications and regulatory affairs
6	Course Outcomes	CO 606.1: Students will be able to describe about upon completion of the course studentshall be able to understand the cGMP aspects in a pharmaceutical industry CO 606.2: Students will be able to associate basic concepts and importance of appreciatethe importance of documentation CO 606.3: Students will be able to interpret andunderstand basic concepts on qualitycertifications applicable to pharmaceutical industries CO 606.4: Students will be able to summarize and understand the responsibilities of QA& QC departments along with GLP and validation aspects CO 404.5: Students will be able to compile Complaints and evaluation of complaints inaddition to Handling of return goods
8	Outline syllabus	
	1	**UNIT–I** **10 Hours** **Quality Assurance and Quality Management concepts:** Definition and concept of Qualitycontrol, Quality assurance and GMP **Total Quality Management (TQM):** Definition, elements, philosophies **ICH Guidelines**: purpose, participants, process of harmonization, Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines Quality by design (QbD)**: Definition, overview, elements of QbD program, tools** ISO 9000 & ISO14000**: Overview, Benefits, Elements, steps for registration** NABL accreditation **: Principles and procedures**
	2	**UNIT-II** **10 Hours** **Organization and personnel:** Personnel responsibilities, training, hygiene and personal records.**Premises:** Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination. **Equipments and raw materials:** Equipment selection, purchase specifications,

		maintenance, purchase specifications and maintenance of stores for raw materials.		
	3	**UNIT–III** **10 Hours** **Quality Control:** Quality control test for containers, rubber closures and secondary packingmaterials. **Good Laboratory Practices:** General Provisions, Organization and Personnel, Facilities, Equipment, Testing Facilities Operation, Test and Control Articles, Protocol for Conduct of a Nonclinical Laboratory Study, Records and Reports, Disqualification of Testing Facilities		
	4	**UNIT–IV** **08 Hours** **Complaints:** Complaints and evaluation of complaints, Handling of return good, recalling andwaste disposal. **Document maintenance in pharmaceutical industry:** Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records.		
	5	**UNIT–V** **07 Hours** **Calibration and Validation:** Introduction, definition and general principles of calibration, qualification and validation, importance and scope of validation, types of validation, validation master plan. Calibration of pH meter, Qualification of UV-Visible spectrophotometer, General principles of Analytical method Validation. **Warehousing:** Good warehousing practice, materials management		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. Quality Assurance Guide by organization of Pharmaceutical Products of India. 2. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69. 3. Quality Assurance of Pharmaceuticals- A compendium of Guide lines and Relatedmaterials Vol I WHO Publications. 4. A guide to Total Quality Management- Kushik Maitra and Sedhan K Ghosh 5. How to Practice GMP's – P P Sharma. 6. ISO 9000 and Total Quality Management – Sadhank G Ghosh 7. The International Pharmacopoeia – Vol I, II, III, IV- General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosage forms 8. Good laboratory Practices – Marcel Deckker Series 9. ICH guidelines, ISO 9000 and 14000 guidelines		

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: V**
1	Course Code	BP607P
2	Course Title	**Medicinal Chemistry III - Practical**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	Upon completion of the course student shall be able to 1. Understand the importance of drug design and different techniques of drug design. 2. Understand the chemistry of drugs with respect to their biological activity. 3. Know the metabolism, adverse effects and therapeutic value of drugs. 4. Know the importance of SAR of drugs.
6	Course Outcomes	**CO607.1**: Student will get fundamental knowledge of the structure,chemistry and its correlation with the therapeutic value of drugs. **CO607.2:** Students will have conceptual knowledge and background ofdrugs and preparation of drugs. **CO607.3:** Students will possess the basic knowledge about the synthesis of sulphanilamide. **CO607.4:** Students will possess the basic knowledge about the synthesis of Chlorobutanol, metronidazole. **CO607.5:** Students will possess the basic knowledge about the synthesis of chloroquine, dapsone
8	Outline Syllabus	
	1	Preparation of Sulphanilamide
	2	Preparation of Chlorpheniramine maleate
	3	Preparation of 7-Hydroxy, 4-methyl coumarin
	4	Preparation of Chloroquine
	5	Preparation of Chlorobutanol
	6	Preparation of Triphenyl imidazole
	7	Preparation of Benzyl penicillin
	8	Preparation of Preparation of Preparation of Tolbutamide
	9	Preparation of Metronidazole
	10	Preparation of Dapsone
	Mode of	Theory/Jury/Practical/Viva

	examination			
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry. 2. Foye's Principles of Medicinal Chemistry. 3. Burger's Medicinal Chemistry, Vol I to IV. 4. Introduction to principles of drug design- Smith and Williams. 5. Remington's Pharmaceutical Sciences. 6. Martindale's extra pharmacopoeia.		

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: VI**
1	Course Code	BP608P
2	Course Title	Pharmacology III- Practical
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	Upon completion of this course the student should be able to 1. Understand the mechanism of drug action and its relevance in the treatment of different diseases 2. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments 3. Demonstrate the various receptor actions using isolated tissue preparation Appreciate correlation of pharmacology with related medical sciences
6	Course Outcomes	CO608.1: Students would be able to define and describe various instruments and methods used in the evaluation of *in vitro* and *in vivo* evaluation of various drugs. CO608.2: Students would be able to understand and explain the working principles of the instruments used and actions of various drugs on biological systems. CO608.3: Students would be able to demonstrate the effects of various categories of drugs and bioassays of physiological substances. CO608.4: Students would be able to analyze and explain the outcomes of experiments through simulation studies. CO608.5: Students would be able to evaluate and discriminate amongst the normal and abnormal physiological processes, and various drugs that can beemployed for different treatment protocols.
8	Outline Syllabus	
	1	Dose calculation in pharmacologicalexperiments
	2	Study of anti-ulcer activity ofa drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model.
	3	Study of effect of drugs on gastrointestinal motility
	4	Effect of agonist and antagonists on guinea pigileum
	5	5. Estimation of serum biochemical parameters byusing semi-autoanalyser
	6	6. Estimation of serum biochemical parameters byusing semi-autoanalyser

	7	7. Effect of saline purgative on frog intestine		
	8	8. Insulin hypoglycemic effect in rabbit		
	9	9. Test for pyrogens (rabbit method)		
	10	10. Determination of acute oral toxicity (LD50) of adrug from a given data		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	'Text book/s*	1. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisherModern Pharmacology with clinical Applications, by Charles R.Craig& Robert, 2. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company,Kolkata, 3. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan, 4. N.Udupa and P.D. Gupta, Concepts in Chronopharmacology.		
	Other References			

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: VI**
1	Course Code	BP609P
2	Course Title	Herbal Drug Technology - Practical
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	1. Explain correct use of various equipments in Pharmacognosy laboratory. 2. Evaluation of drugs and various formulations 3. Demonstrate various herbal preparations 4. Formulations of various herbal cosmetics 5. Analyse the phytoconstituents
6	Course Outcomes	CO609.1Students would able to prepare crude drug extract, identify extract through phytochemical screening and also identify herbal drugs through chemical test CO609.2:Students would be able to distinguish exciepients of natural origin and estimatealcohol content in alcoholic formulations CO609.3:Students would be able to prepare herbal creams, shampoo CO609.4: Students would be able to analyse evaluation parameters for herbal shampooand creams CO609.5:Students would be able to formulate syrups and evaluate it
7	Course Description	1. To perform preliminary phytochemical screening of crude drugs. 2. Determination of the alcohol content of Asava and Arista 3. Evaluation of excipients of natural origin 4. Incorporation of prepared and standardized extract in cosmetic formulations likecreams, lotions and shampoos and their evaluation. 5. Incorporation of prepared and standardized extract in formulations like syrups, mixturesand tablets and their evaluation as per Pharmacopoeial requirements. 6. Monograph analysis of herbal drugs from recent Pharmacopoeias 7. Determination of Aldehyde content 8. Determination of Phenol content Determination of total alkaloids
8	Outline Syllabus	
	1	To determine phenol content in clove oil.
	2	To determine total alkaloids in crude drug sample.
	3	Evaluation of excipients of natural origin
	4	Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation.
	5	To perform Preliminary phytochemical screening of crude drugs.
	6	To determine the alcohol content of Asava and Arishta.
	7	To formulate and evaluate herbal cream containing Curcumalonga.

	8	To formulate and evaluate Polyherbal shampoo.		
	9	To formulate and evaluate herbal cough syrup		
	10	To perform Preliminary phytochemical screening of crude drugs.		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. Textbook of Pharmacognosy by Trease & Evans. 2. Textbook of Pharmacognosy by Tyler, Brady & Robber. 3. Pharmacognosy by Kokate, Purohit and Gokhale 4. Essential of Pharmacognosy by Dr.S.H.Ansari 5. Pharmacognosy & Phytochemistry by V.D.Rangari		

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: VII**
1	Course Code	BP701T
2	Course Title	Instrumental Methods of Analysis
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of this course the student should be able to 1. Understand the interaction of matter with electromagnetic radiations andits applications in drug analysis. 2. Understand various techniques in Analysis of various Pharmaceuticals. 3. Study the applications of various Instruments in analysis of Pharmaceuticals. 4. Perform quantitative & qualitative analysis of drugs using various analytical instruments.
6	Course Outcomes	**CO701.1**: Student will get fundamental knowledge of Analyticaltechniques in Instrumental Methods of Analysis. **CO701.2:** Students will have conceptual knowledge about principle ofModern instruments using in Analysis of Pharmaceuticals **CO701.3:** Students will possess the basic knowledge about applications of Modern instruments using in Analysis of Pharmaceuticals **CO701.4:** Student will learn how to operate the Modern instruments inanalysis of Pharmaceuticals. **CO701.5:** Students will be able to understand the chromatographic separation and analysis of drugs.
7	Course Description	Subject covers various modern instruments used in analysis of Pharmaceuticals.
8	Outline syllabus	
	1	**UV Visible spectroscopy** Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations. Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode. Applications - Spectrophotometric titrations, Single component and multi component analysis **Fluorimetry**
	2	**IR spectroscopy**

		Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector and applications **Flame Photometry**-Principle, interferences, instrumentation and applications **Atomic absorption spectroscopy**- Principle, interferences, instrumentation and applications **Nepheloturbidometry**- Principle, instrumentation and applications		
	3	**Introduction to chromatography** **Adsorption and partition column chromatography**-Methodology, advantages,disadvantages and applications. **Thin layer chromatography-** Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications. **Paper chromatography**-Introduction, methodology, development techniques, advantages, disadvantages and applications **Electrophoresis**– Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications		
	4	**Gas chromatography -** Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications **High performance liquid chromatography (HPLC)-**Introduction, theory, instrumentation, advantages and applications.		
	5	**Ion exchange chromatography-** Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications **Gel chromatography-** Introduction, theory, instrumentation and applications **Affinity chromatography-** Introduction, theory, instrumentation and applications		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*			
	Other	**Recommended Books (Latest Editions)**		

	References	1. Instrumental Methods of Chemical Analysis by B.K Sharma 2. Organic spectroscopy by Y.R Sharma 3. Text book of Pharmaceutical Analysis by Kenneth A. Connors 4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel 5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake 6. Organic Chemistry by I. L. Finar 7. Organic spectroscopy by William Kemp 8. Quantitative Analysis of Drugs by D. C. Garrett 9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi 10. Spectrophotometric identification of Organic Compounds by Silverstein

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: VII**
1	Course Code	BP-702T
2	Course Title	Industrial Pharmacy-II Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the course, the student shall be able to: 1. Know the process of pilot plant and scale up of pharmaceutical dosageforms 2. Understand the process of technology transfer from lab scale to commercial batch 3. Know different Laws and Acts that regulate pharmaceutical industry 4. Understand the approval process and regulatory requirements for drug products
6	Course Outcomes	CO702.1: Students shall have knowledge about the process of pilot plantand scale up of pharmaceutical dosage forms CO702.2: Students shall have knowledge about the process of technology transfer from lab scale to commercial batch. CO702.3: Students shall be able to understand about stepwise productdevelopment process from NDA filing to final FDA submission CO702.4 Students shall be to able to analyze the different laws and actsthat regulate pharmaceutical industry in India and US CO702.5: Students shall be to able to Understand Develop the concept ofquality management and knowledge of required certifications
7	Course Description	This course is designed to impart fundamental knowledge on pharmaceutical product development and translation from laboratory tomarket
8	Outline syllabus	
	Unit 1	Pilot plant scale up techniques:
	Pilot plant scale up techniques: General considerations - including significance of personnel requirements, space requirements, raw materials, Pilot plant scale up considerations for solids, liquid orals, semi solids and relevant documentation, SUPAC guidelines, Introduction to platform technology.	
	Unit 2	Technology development and transfer

	Technology development and transfer: WHO guidelines for Technology Transfer(TT): Terminology, Technology transfer protocol, Quality risk management, Transfer from R & D to production (Process, packaging and cleaning), Granularity of TT Process (API, excipients, finished products, packaging materials) Documentation, Premises and equipments, qualification and validation, quality control, analytical method transfer, Approved regulatory bodies and agencies, Commercialization - practical aspects and problems (case studies), TT agencies in India - APCTD, NRDC,TIFAC, BCIL, TBSE / SIDBI; TT related documentation - confidentiality agreement, licensing, MoUs, legal issues			
	Unit 3	Regulatory affairs		
	Regulatory affairs: Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, Role of Regulatory affairs department, Responsibility of Regulatory Affairs Professionals Regulatory requirements for drug approval: Drug Development Teams, Non-Clinical Drug Development, Pharmacology, Drug Metabolism and Toxicology, General considerations of Investigational New Drug (IND) Application, Investigator's Brochure (IB) and New Drug Application (NDA), Clinical research / BE studies, Clinical Research Protocols, Biostatistics in Pharmaceutical Product Development, Data Presentation for FDA Submissions, Management of Clinical Studies			
	Unit 4	Quality management systems		
	Quality management systems: Quality management & Certifications: Concept of Quality, Total Quality Management, Quality by Design (QbD),Six Sigma concept, Out of Specifications (OOS), Change control, Introduction to ISO 9000 series of quality systems standards, ISO 14000, NABL, GLP			
	Unit 5	Indian Regulatory Requirements		
	Indian Regulatory Requirements: Central Drug Standard Control Organization (CDSCO) and State Licensing Authority: Organization, Responsibilities, Certificate of Pharmaceutical Product (COPP), Regulatoryrequirements and approval procedures for New Drugs			
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s	1. Regulatory Affairs from Wikipedia, the free encyclopedia modified on 7th April available at http,//en.wikipedia.org/wiki/Regulatory_ Affairs. 2. International Regulatory Affairs Updates, 2005. available at http://www.iraup.com/about.php 3. Douglas J Pisano and David S. Mantus. Text bookof FDA Regulatory Affairs A Guide for Prescription Drugs, Medical Devices, and Biologics' Second Edition. 4. Regulatory Affairs brought by learning plus, inc. available at http.//www.cgmp.com/ra.htm.		

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester:VII**
1	Course Code	BP703T
2	Course Title	Pharmacy Practice Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Objectives: Upon the completion of this course the students shall be able to 1. know various drug distribution methods in a hospital 2. appreciate the pharmacy stores management and inventory control 3. monitor drug therapy of patient through medication chart review and clinical review 4. obtain medication history interview and counsel the patients 5. identify drug related problems 6. detect and assess adverse drug reactions 7. interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states 8. know pharmaceutical care services 9. do patient counselling in community pharmacy; 10. Appreciate the concept of rational drug therapy.
6	Course Outcomes	CO703.1Ability to discuss the controversies in drug therapy CO703.2Ability to perform the therapeutic approach to management ofhospital CO703.3Ability to identify the patient specific parameters relevant inmonitoring therapy CO703.4Understand the importance of individualized therapeutic plans based on diagnosis CO703.5Ability to compile data collected at their research work
7	Course Description	This course has been designed to impart the fundamental knowledge of pharmacy practice and ethics along with the aspects of hospital organization.
8	Outline syllabus	
	Unit 1	**Hospital and it's organization**

	A. Definition, Classification of hospital- Primary, Secondary and Tertiary hospitals, Classification based on clinical and non- clinical basis, Organization Structure of a Hospital, and Medical staffs involved in the hospital and their functions. B. Definition, functions of hospital pharmacy,Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists Classifications - Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicity following sudden withdrawal of drugs, Drug interaction- beneficial interactions, adverse interactions, and pharmacokinetic drug interactions, Methods for detecting drug interactions, spontaneous case reports and record linkage studies, and Adverse drug reaction reporting and management. C. Organization and structure of retail and wholesale drug store, types and design, Legal requirements for establishment and maintenance of a drug store, Dispensing of proprietary products, maintenance of records of retail and wholesale drug store.	
	Unit 2	**Drug distribution system in a hospital**
	A. Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labelling, Dispensing of drugs to ambulatory patients, and Dispensing of controlled drugs. Definition, contents of hospital formulary, Differentiation of hospital formulary and Drug list, preparation and revision, and addition and deletion of drug from hospital formulary. B. Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring,and Indian scenario for Therapeutic Drug Monitoring. Causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patientmedication adherence. C. Need for the patient medication history interview,medication interview forms. Financial, materials, staff, and infrastructure requirements	
	Unit 3	**Pharmacy and therapeutic committee**
	A. Organization, functions, Policies of the pharmacy and therapeutic committee in including drugs into formulary, inpatient and outpatient prescription, automatic stop order, and emergency drug list preparation. Drug and Poison information centre, Sources of drug information, Computerised services,and storage and retrieval of information. B. Definition of patient counseling; steps involved in patient counseling, and Special cases that require the pharmacist.Role of pharmacist in the education and training program, Internal and external training program, Services to the nursing homes/clinics, Codeof ethics for community pharmacy, and Role of pharmacist in the interdepartmental communication and community health education. C. Prescribed medication order- interpretation and legal requirements, and Communication skills- communication with prescribers and patients.	
	Unit 4	**Budget preparation and implementation**
	A. Budget preparation and implementation. B. Introduction to Clinical Pharmacy, Concept of clinical pharmacy, functions and responsibilities of clinical pharmacist, Drug therapy monitoring - medication chart review, clinical review, pharmacist intervention, Ward round participation, Medication history and Pharmaceutical care.Dosing pattern and drug therapy based on Pharmacokinetic & disease pattern. C. Introduction and sale of over the counter, and Rationaluse of common over the counter medications.	
	Unit 5	**Drug store management and inventory control**

	A. Organisation of drug store, types of materials stocked and storage conditions, Purchase and inventory control: principles, purchase procedure, purchase order, procurement and stocking, Economic order quantity, Reorder quantity level, and Methods used for the analysis of the drug expenditure Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee. B. Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee. C. Blood chemistry, hematology, and urinalysis.			
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*			
	Other References	1. Merchant S.H. and Dr. J.S.Quadry. *A textbook of hospital pharmacy*, 4th ed. Ahmadabad: B.S. Shah Prakakshan; 2001. 2. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. *A textbook of Clinical Pharmacy Practice- essential concepts and skills*, 1st ed. Chennai: OrientLongman Private Limited; 2004. 3. William E. Hassan. *Hospital pharmacy*, 5th ed.Philadelphia: Lea & Febiger; 1986. 4. Tipnis Bajaj. *Hospital Pharmacy*, 1st ed. Maharashtra: Career Publications; 2008. 5. Scott LT. *Basic skills in interpreting laboratory data*, 4thed. American Society of Health System Pharmacists Inc; 2009. 5. Parmar N.S. *Health Education and Community Pharmacy*, 18th ed. India: CBS Publishers &Distributers; 2008.		

School:		**SOP**
Program:		**B. Pharm**
Branch:		**Semester: VII**
1	Course Code	BP 704T
2	Course Title	**Novel drug delivery systems- Theory**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	After the successful completion of this course, the student shall be able to: 1. The course aims to provide an understanding of basic knowledge on the area of novel drug delivery systems. 2. To understand various approaches for development of novel drug delivery systems. 3. To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation
6	Course Outcomes	**CO704.1**: The students will understand the concepts and applications of NovelDrug Delivery Systems and to study various properties for sustained and controlleddrug delivery systems. **CO704.2:** The student will be able to Apply knowledge in developing various novel formulations as per requirements and to learn mucosal and Implantable drugdelivery. **CO704.3:** The student will be able to Analyze various evaluation parameters for oral, parenteral, topical etc. drug delivery systems. **CO704.4:** The students will analyze the Formulate industrially feasible, cost effective strategy for development of new dosage forms **CO704.5:** The students will be able to Learn about site specific drug delivery. and To study ocular drug delivery its issues and challenges, drug selection.
7	Course Description	**Scope:** This subject is designed to impart basic knowledge on the area of novel drug delivery systems. To understand various approaches for development of novel drug delivery systems. To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation
8	Outline syllabus	
	1	**Controlled drug delivery systems**: Introduction, terminology/definitions and rationale, advantages, disadvantages, selection of drug candidates.Approaches to design controlled release formulations based on diffusion, dissolution and ion exchange principles. Physicochemical and biological properties of drugs relevant to controlled release formulations **B. Polymers:** Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems.
	2	

		A. Microencapsulation: Definition, advantages and disadvantages, microspheres /microcapsules, microparticles, methods of microencapsulation, applications **B. Mucosal Drug Delivery system:** Introduction, Principles of bioadhesion / mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations of buccal delivery systems **Implantable Drug Delivery Systems:**Introduction, advantages and disadvantages, concept of implantsand osmotic pump		
	3	**A. Transdermal Drug Delivery Systems:** Introduction, Permeation through skin,factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches **B. Gastroretentive drug delivery systems:** Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high density systems, inflatable and gastroadhesive systems and their applications		
	4	**A. Targeted drug Delivery:** Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications		
	5	**A. Ocular Drug Delivery Systems:** Introduction, intra ocular barriers and methods to overcome –Preliminary study, ocular formulations and ocuserts **B. Intrauterine Drug Delivery Systems:** Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*			
	Other References	**Recommended Books (Latest Editions)** 1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revisedand expanded, 2. Marcel Dekker, Inc., New York, 1992. 3. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, 4. Inc., New York, 1992. 5. Encyclopedia of Controlled Delivery. Edith Mathiowitz,Published by Wiley 6. Interscience Publication, John Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi 7. Spectrophotometric identification of Organic Compounds by Silverstein.		

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: VII**
1	Course Code	BP705P
2	Course Title	Instrumental Methods of Analysis- theory
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Type	Compulsory
5	Course Objective	Upon completion of this course the student should be able to 1. Understand applications of instruments in drug analysis 2. Understand operation of instruments in Analysis of various Pharmaceuticals. 3. Study the preparation of various analytes 4. Perform quantitative & qualitative analysis of drugs using various analyticalinstruments.
6	Course Outcomes	**CO705.1**: Student will get fundamental knowledge of Analyticaltechniques in Instrumental Methods of Analysis. **CO705.2:** Students will have conceptual knowledge about operation of Modern instruments using in Analysis of Pharmaceuticals **CO705.3:** Students will possess the basic knowledge about applications of Modern instruments using in Analysis of Pharmaceuticals **CO705.4:** Student will learn how to operate the Modern instruments in analysis of Pharmaceuticals. **CO705.5:** Students will be able to understand the chromatographic separationand analysis of drugs.
7	Course Description	Subject covers operation of various modern instruments used in analysis of Pharmaceuticals
8	Outline syllabus	
	1	Determination of absorption maxima and effect of solvents on absorptionmaxima of organic compounds.
	2	Estimation of dextrose by colorimetry
	3	Estimation of sulfanilamide by colorimetry
	4	Simultaneous estimation of ibuprofen and paracetamol by UVspectroscopy.
	5	Assay of paracetamol by UV- Spectrophotometry
	6	Estimation of quinine sulfate by fluorimetry.
	7	Study of quenching of fluorescence
	8	Determination of sodium by flame photometry
	9	Determination of potassium by flame photometry
	10	Determination of chlorides and sulphates by nephelo turbidometry
	11	Separation of amino acids by paper chromatography
	12	Separation of sugars by thin layer chromatography
	Mode of	**Theory/Jury/Practical/Viva**

	examination			
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*			
	Other References	**Recommended Books (Latest Editions)** 1. Instrumental Methods of Chemical Analysis by B.K Sharma 2. Organic spectroscopy by Y.R Sharma 3. Text book of Pharmaceutical Analysis by Kenneth A. Connors 4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel 5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake 6. Organic Chemistry by I. L. Finar 7. Organic spectroscopy by William Kemp 8. Quantitative Analysis of Drugs by D. C. Garrett 9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi Spectrophotometric identification of Organic Compounds by Silverstein		

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: VIII**
1	Course Code	BP801T
2	Course Title	**Biostatistics & Research Methodology- Theory**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	1. Know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment) 2. Know the various statistical techniques to solve statistical problems 3. Appreciate statistical techniques in solving the problems
6	Course Outcomes	CO801.1: Describe statistics, Biostatistics and interpretation of frequency distribution table, and their pharmaceutical examples(K2, K5) CO801.2: Calculate the measures of central tendency and dispersion of a data and describe the method used for analysis, including a discussion of advantages, disadvantages, and necessary assumptions. (K2, K3) CO801.3: Describe the properties of Regression, Curve fitting, Multiple regression and their pharmaceutical examples. (K2). CO801.4: Calculate and interpret the correlation between two variables and Calculate the simple linear regression equation for a set of data and know the basic assumptions behind regression analysis. (K2, K3) CO801.5: Understand the concept of Probability and different types of distributions, Poisson's distribution and its properties. (K2, K5)
7	Course Description	This is an introductory course in statistics. Students are introduced to the fundamental concepts involved in using sample data to make inferences about populations. Included are the study of measures of central tendency and dispersion, finite probability, statistical inferences from large and small samples, linear regression, and correlation.
8	Outline syllabus	
	1	**Unit-I** **Introduction:** Statistics, Biostatistics, Frequency distribution **Measures of central tendency**: Mean, Median, Mode- Pharmaceutical examples **Measures of dispersion**: Dispersion, Range, standard deviation, Pharmacutical problems **Correlation**: Definition, Karl Pearson's coefficient of correlation, Multiple correlation - Pharmaceuticals examples
	2	**Unit-II** **Regression:** Curve fitting by the method of least squares, fitting the lines y= a + bx and x = a + by, Multiple regression, standard error of regression–

		Pharmaceutical Examples **Probability:**Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution, properties - problems Sample, Population, large sample, small sample, Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, Error-I type, Error-II type, Standard error of mean (SEM) - Pharmaceutical examples **Parametric test**: t-test(Sample, Pooled or Unpaired and Paired) , ANOVA, (One way and Two way), Least Significance difference		
	3	**Unit-III** **10** **Hours** **Non Parametric tests:** Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallis test, Friedman Test **Introduction to Research:** Need for research, Need for design of Experiments, Experiential Design Technique, plagiarism **Graphs:** Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph **Designing the methodology:** Sample size determination and Power of a study, Report writing and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, various phases.		
	4	**Unit-IV**Blocking and confounding system for Two-level factorials**Regression modeling:** Hypothesis testing in Simple and Multiple regression models**Introduction to Practical components of Industrial and Clinical Trials Problems**: ®Statistical Analysis Using Excel, SPSS, MINITAB DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach		
	5	**Unit-V** **Design and Analysis of experiments:** **Factorial Design:** Definition, 2 , 2 design. Advantage of factorial design **Response Surface methodology**: Central composite design, Historical design, Optimization Techniques		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*			
	Other References	**Recommended Books (Latest edition):** 1. Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, publisher Marcel Dekker Inc. NewYork. 2. Fundamental of Statistics – Himalaya Publishing House- S.C.Guptha		

		3. Design and Analysis of Experiments –PHI Learning Private Limited, R. Pannerselvam, 4. Design and Analysis of Experiments – Wiley Students Edition, Douglas and C. Montgomery

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: VIII**
1	Course Code	BP802T
2	Course Title	**Social & Preventive Pharmacy- Theory**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of this course the student should be able to 1. Acquire high consciousness/realization of current issuesrelated to health and pharmaceutical problems within the country and worldwide. 2. Have a critical way of thinking based on current healthcare development. 3. Evaluate alternative ways of solving problems related tohealth and pharmaceutical issues
6	Course Outcomes	**CO802.1**:The students will understand the issues related to social issues ofhealth. **CO802.2:**The student will be able to summarize the impact of govt. health policies run for various health issues. **CO802.3:**The student will be able to apply the knowledge of understandingthe health issues of the society on finding the effective solution for eradication of diseases. **CO802.4:**The students will analyze the correlation of various factors affecting the health status of common people and will assess the action plansto combat the health issues. **CO802.5:**The students would evaluate the processes of various nationalprograms related to social health and prevention of various disease.
7	Course Description	The purpose of this course is to introduce to students a number of health issues and their challenges. This course also introduced a number of national health programmes. The roles of the pharmacist in these contexts are also discussed.
8	Outline syllabus	
	1	**Unit I:** **Concept of health and disease:** Definition, concepts and evaluation of public health. Understanding the concept of prevention and control of disease, social causes of diseases and social problems of the sick. **Social and health education:** Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention. **Sociology and health:** Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Poverty and health **Hygiene and health:** personal hygiene and health care; avoidable habits
	2	**Unit II:** **Preventive medicine:** General principles of prevention and control of diseases such as cholera, SARS, Ebola virus, influenza, acute respiratory infections,

		malaria, chicken guinea, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse		
	3	**Unit III:National health programs, its objectives, functioning and outcome of the following:** HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program, National programme for prevention and control of deafness, Universal immunization programme, National programme for control of blindness, Pulse polio programme.		
	4	**Unit IV:**National health intervention programme for mother and child, National family welfare programme, National tobacco control programme, National Malaria Prevention Program, National programme for the health care for the elderly, Social health programme; role of WHO in Indian national program		
	5	**Unit V:** Community services in rural, urban and school health: Functions of PHC, Improvement in rural sanitation, national urban health mission, Health promotion and education in school.		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*			
	Other References	**Recommended Books (Latest Editions)** 1. Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2 2010, ISBN: 9789380704104, JAYPEE Publications Edition, 2. Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by Royth Edition, 2013, ISBN: 9789350901878, JAYPEE 3. Rabindra Nath, Saha Indranil, 4 Publications Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6 Edition, 2014, ISBN: 9789351522331, JAYPEE Publications 4. Essentials of Community Medicine—A Practical Approach, Hiremath Lalita D, nd 5. Hiremath Dhananjaya A, 2 Edition, 2012, ISBN: 9789350250440, JAYPEE Publications Park Textbook of Preventive and Social Medicine, K Park, 21 Edition, 2011, 6. ISBN-14: 9788190128285, BANARSIDAS BHANOT PUBLISHERS. Community Pharmacy Practice, Ramesh Adepu, BSP publishers, Hyderabad		

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: VIII**
1	Course Code	BP803ET
2	Course Title	Pharma marketing management- Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	After the successful completion of this course, the student shall be able to: 1. The course aims to provide an understanding of marketing concepts and techniques and their applications in the pharmaceutical industry 2. Have a critical way of thinking based on different marketing strategy for product development. 3. The aim here is to develop a community around the brand whereby audiences can interact with certain content. In the pharmaceutical industry, more so big pharma, and just like most other consumer-facing industries, there are more products and more messages subsequently meaning more noise.
6	Course Outcomes	**CO803.1**: The students will understand the Marketing concepts and techniquesand the application of the same in the pharmaceutical industry. **CO803.2:** The student will be able to summarize the Market research and distribution channels along with their implementation in the pharmaceutical industry. **CO803.3:** The student will be able to apply the knowledge of understandingthe Concepts of product line and product mix decisions, branding and product management. **CO803.4:** The students will analyze the Theories on promotion techniques forOTC Products, sales and pricing of a product. **CO803.5:** The students would evaluate the processes of issues in price management in pharmaceutical industry and Global Marketing concept.
7	Course Description	The pharmaceutical industry not only needs highly qualified researchers, chemists and, technical people, but also requires skilled managers who can take the industry forward by managing and taking the complex decisions which are imperative for the growth of the industry. The Knowledge and Know-how of marketing management groom the people for taking a challenging role in Sales and Product management.
8	Outline syllabus	
	1	**Unit I: Marketing:** Definition, general concepts and scope of marketing; Distinction between marketing & selling; Marketing environment; Industry and competitive analysis; Analyzing consumer buying behavior; industrial buying behavior. **Pharmaceutical market:**

		Quantitative and qualitative aspects; size and composition of the market; demographic descriptions and socio-psychological characteristics of the consumer; market segmentation& targeting.Consumer profile; Motivation and prescribing habits of the physician; patients' choice of physician and retail pharmacist.Analyzing the Market;Role of market research.		
	2	**Unit II:** **Product decision:** Classification, product line and product mix decisions, product life cycle,product portfolio analysis; product positioning; New product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry.		
	3	**Unit III:** **Promotion:** Methods, determinants of promotional mix, promotional budget; An overview of personal selling, advertising, direct mail, journals, sampling, retailing,medical exhibition, public relations, online promotional techniques for OTC Products.		
	4	**Unit IV:** **Pharmaceutical marketing channels:** Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physical distribution management. **Professional sales representative (PSR):** Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR.		
	5	**Unit V:** **Pricing:** Meaning, importance, objectives, determinants of price; pricing methods and strategies, issues in price management in pharmaceutical industry. An overview of DPCO (Drug Price Control Order)and NPPA (National Pharmaceutical Pricing Authority). **Emerging concepts in marketing:** Vertical & Horizontal Marketing; RuralMarketing; Consumerism; Industrial Marketing; Global Marketing.		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*			
	Other References	**Recommended Books: (Latest Editions)** 1. Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India, New Delhi		

		2. Walker, Boyd and Larreche : Marketing Strategy- Planning and Implementation, Tata MC GrawHill, New Delhi. 3. Dhruv Grewal and Michael Levy: Marketing, Tata MC Graw Hill 4. Arun Kumar and N Menakshi: Marketing Management, Vikas Publishing, India 5. Rajan Saxena: Marketing Management; Tata MC Graw-Hill (India Edition) 6. Ramaswamy, U.S & Nanakamari, S: Marketing Managemnt:Global Perspective, IndianContext,Macmilan India, New Delhi. 7. Shanker, Ravi: Service Marketing, Excell Books, New Delhi 8. Subba Rao Changanti, Pharmaceutical Marketing in India (GIFT – Excel series) Excel 7. Rabindra Nath, Saha Indranil, 4 Publications Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6 Edition, 2014, ISBN: 9789351522331, JAYPEE Publications 8. Essentials of Community Medicine—A Practical Approach, Hiremath Lalita D, nd 9. Hiremath Dhananjaya A, 2 Edition, 2012, ISBN: 9789350250440, JAYPEE Publications Park Textbook of Preventive and Social Medicine, K Park, 21 Edition, 2011, 10. ISBN-14: 9788190128285, BANARSIDAS BHANOT PUBLISHERS. Community Pharmacy Practice, Ramesh Adepu, BSP publishers, Hyderabad

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: V**
1	Course Code	BP804ET
2	Course Title	Pharmaceutical Regulatory Science - Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Compulsory
5	Course Objective	Upon completion of the subject student shall be able to; Know about the process of drug discovery and development Know the regulatory authorities and agencies governing the manufacture and saleof pharmaceuticals Know the regulatory approval process and their registration in Indian andinternational markets
6	Course Outcomes	Students would be able to understand CO804.1about the process of drug discovery and development CO804.2 the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals CO804.3 the regulatory approval process CO804.4 the registration of drug in Indian and international market. CO804.5 about clinical trials, ethical committee and protocol designing.
8	Outline syllabus	
	1	**Unit I** **New Drug Discovery and development** Stages of drug discovery, Drug development process, pre-clinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development.
	2	**Unit II** **Regulatory Approval Process** Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA / ANDA. **Regulatory authorities and agencies** Overview of regulatory authorities of India, United States, European Union, Australia,

		Japan, Canada (Organization structure and types of applications)		
	3	**Unit III** **Registration of Indian drug product in overseas market** Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical Document (eCTD), ASEAN Common Technical Document (ACTD)research. pelletization process, equipmentsfor manufacture of pellets		
	4	**Unit IV** **Clinical trials** Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance - safety monitoring in clinical trials		
	5	**Unit V** **Regulatory Concepts** Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**	Sessional Exam	ESE
		10 Marks	15	75
	Text book/s*	1. Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan. 2. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences,Vol.185. Informa Health care Publishers. 3. New Drug Approval Process: Accelerating Global Registrations By Richard AGuarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences,Vol.190. 4. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley &Sons. Inc. 5. FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited by Douglas J. Pisano, David Mantus. 6. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel andIsader Kaufer, Marcel Dekker series, Vol.143 7. Clinical Trials and Human Research: A Practical Guide to Regulatory ComplianceBy Fay A. Rozovsky and Rodney K. Adams 8. Principles and Practices of Clinical Research, Second Edition Edited by John I.Gallin and Frederick P. Ognibene 9. Drugs: From Discovery to Approval, Second Edition By Rick Ng		

School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: VIII**
1	Course Code	BP805ET
2	Course Title	Pharmacovigilance Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	Elective
5	Course Objective	Objectives: Upon the completion of this course the students shall be able to Tell Why drug safety monitoring is important? History and development of pharmacovigilance National and international scenario of pharmacovigilance Dictionaries, coding and terminologies used in pharmacovigilanceDetection of new adverse drug reactions and their assessment International standards for classification of diseases and drugs Adverse drug reaction reporting systems and communication in pharma covigilance Methods to generate safety data during pre clinical, clinical and post approval phases of drugs' life cycle Drug safety evaluation in paediatrics, geriatrics, pregnancy and lactation Pharmacovigilance Program of India (PvPI) requirement for ADR reporting in India ICH guidelines for ICSR, PSUR, expedited reporting, pharmacovigilanceplanning CIOMS requirements for ADR reporting Writing case narratives of adverse events and their quality.
6	Course Outcomes	Student will be able to CO805.1 discuss the history of Pharmacovigilance CO805.2 perform the Detection of new adverse drug reactions and their assessment CO805.3 identify the suspected drug events CO805.4 understand the importance of PV PI CO805.5 compile reports like ICSR, PSUR
7	Course Description	This course has been designed to impart the fundamental knowledge of pharmacy practice and ethics along with the aspects of hospital organization.
8	Outline syllabus	
	1	**1. Introduction to Pharmacovigilance** a. History and development of Pharmacovigilance b. Importance of safety monitoring of Medicine c. WHO international drug monitoring programme 2. Pharmacovigilance Program of India(PvPI) **3. Introduction to adverse drug reactions** Definitions and classification of ADR

		Detection and reportin Methods in Causality assessment Severity and seriousness assessment Predictability and preventability assessment prevention. Management of adverse drug reactions **4. Basic terminologies used in pharmacovigilance** Terminologies of adverse medication related events Regulatory terminologies
	2	**Drug and disease classification** **Drug dictionaries and coding in pharmacovigilance** Anatomical, therapeutic and chemical classification of drugs International classification of diseases Daily defined doses International Non proprietary Names for drugs **Information resources in pharmacovigilance** Basic drug information resources Specialised resources for ADRs WHO adverse reaction terminologies MedDRA and Standardised MedDRA queries WHO drug dictionary Eudravigilance medicinal product dictionary **Establishing pharmacovigilance programme** Establishing in a hospital Establishment & operation of drug safety department inindustry Contract Research Organisations (CROs) Establishing a national programme
	3	**Vaccine safety surveillance** Vaccine Pharmacovigilance Vaccination failureAdverse events following immunization **Pharmacovigilance methods**Passive surveillance – Spontaneous reports and case series Stimulated reporting Active surveillance – Sentinel sites, drug event monitoring and registries Comparative observational studies – Cross sectionalstudy, case control study and cohort study Targeted clinical investigations **Communication in pharmacovigilance** Effective communication in Pharmacovigilance Communication in Drug Safety Crisis management Communicating with Regulatory Agencies, BusinessPartners, Healthcare facilities & Media
	4	**Safety data generation**

<table>
<tr><td></td><td></td><td colspan="3">1. Pre clinical phase
2. Clinical phase
3. Post approval phase (PMS)

ICH Guidelines for Pharmacovigilance
1. Organization and objectives of ICH
2. Expedited reporting
3. Individual case safety reports
4. Periodic safety update reports
5. Post approval expedited reporting
6. Pharmacovigilance planning
7. Good clinical practice in pharmacovigilance studies</td></tr>
<tr><td></td><td>5</td><td colspan="3">Pharmacogenomics of adverse drug reactions. Genetics related ADR with example focusing PKparameters.
Drug safety evaluation in special population
□□ Paediatrics
□□ Pregnancy and lactation
□□ Geriatrics
CIOMS
□□ CIOMS Working Groups
□□ CIOMS Form
CDSCO (India) and Pharmacovigilance
□□ D&C Act and Schedule Y
□□ Differences in Indian and global pharmacovigilancerequirements</td></tr>
<tr><td></td><td>Mode of examination</td><td colspan="3">Theory/Jury/Practical/Viva</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">Weightage Distribution</td><td>Continuous Mode Assessment</td><td>Sessional Exam</td><td>ESE</td></tr>
<tr><td>10 Marks</td><td>15</td><td>75</td></tr>
<tr><td></td><td>Text book/s*</td><td colspan="3"></td></tr>
<tr><td></td><td>Other References</td><td colspan="3">Recommended Books (Latest edition)
Textbook of Pharmacovigilance: S K Gupta, Jaypee Brothers, Medical Publishers.
Practical Drug Safety from A to Z By Barton Cobert, Pierre Biron, Jones andBartlett Publishers.
Mann's Pharmacovigilance:Elizabeth B. Andrews, Nicholas, Wiley Publishers.
Stephens' Detection of New Adverse Drug Reactions: John Talbot, Patrick Walle,Wiley Publishers.
An Introduction to Pharmacovigilance: Patrick Waller,Wiley Publishers.
Cobert's Manual of Drug Safety and Pharmacovigilance: Barton Cobert,Jones&Bartlett Publishers.</td></tr>
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School:		**SOP**
Program:		**B.Pharm**
Branch:		**Semester: VIII**
1	Course Code	BP808ET
2	Course Title	Cell and molecular biology - Theory
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Type	**Elective**
5	Course Objective	Upon the completion of the course student shall be able to: 1. Summarize cell and molecular biology history. 2. Summarize cellular functioning and composition. 3. Describe the chemical foundations of cell biology. a. Summarize the DNA properties of cell biology. b. Describe protein structure and function. 4. Describe cellular membrane structure and function. 5. Describe basic molecular genetic mechanisms.
6	Course Outcomes	CO808.1: Students would be able to understand the concept of cell theoryand basics of cellular structure and the mechanism of immune system. CO808.2: Students would be able to understand cellular reproduction ineukaryotic cells and increase their knowledge about nucleic acids CO808.3: Students would be able to understand DNA, RNA and their rolein central dogma of life, Protein synthesis and types of RNA. CO808.4: Students would be able to describe Transgenics and GenomicAnalysis, Cell Cycle analysis, role of genetics, mitosis and meiosis. CO808.5: Students would be able to explain Cell Signals, Receptors for Cell Signals, Signaling Pathways, Misregulation of Signaling Pathways and Protein- Kinases: Functioning
7	Course Description	
8	Outline syllabus	
	1	**Unit I** 1. Cell and Molecular Biology: Definitions theory and basics and Applications. 2. Cell and Molecular Biology: History and Summation. 3. Properties of cells and cell membrane. 4. Prokaryotic versus Eukaryotic 5. Cellular Reproduction 6. chemical Foundations – an Introduction and Reactions (Types)
	2	**Unit II** 1. DNA and the Flow of Molecular Information 2. DNA Functioning 3. DNA and RNA 4. Types of RNA 5. Transcription and Translation
	3	**Unit III**

		1. Proteins: Defined **and** Amino Acids 2. Protein Structure 3. c)Regularities in Protein Pathways 4. Cellular Processes 5. Positive Control and significance of Protein Synthesis		
	4	**Unit IV** 1. Science of Genetics 2. Transgenics and Genomic Analysis 3. Cell Cycle analysis 4. Mitosis and Meiosis 5. Cellular Activities and Checkpoints		
	5	**Unit V** 1. Cell Signals: Introduction 2. Receptors for Cell Signals 3. Signaling Pathways: Overview 4. Misregulation of Signaling 5. Pathways Protein-Kinases: Functioning		
	Mode of examination	Theory/Jury/Practical/Viva		
	Weightage Distribution	**Continuous Mode Assessment**		ESE
		10 Marks		75
	Text book/s*			
	Other References	**Recommended Books (latest edition):** 1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London. 2. Prescott and Dunn., Industrial Microbiology, 4 Distributors, Delhi. edition, CBS Publishers & 3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn. 4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology. 5. Rose: Industrial Microbiology. 6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan 7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution. 8. Peppler: Microbial Technology. 9. Edward: Fundamentals of Microbiology. 10. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi 11. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly a. company 12. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and 13. Applications of RecombinantDNA: ASM Press Washington D.C 14. RA Goldshy et. al., : Kuby Immunology.		